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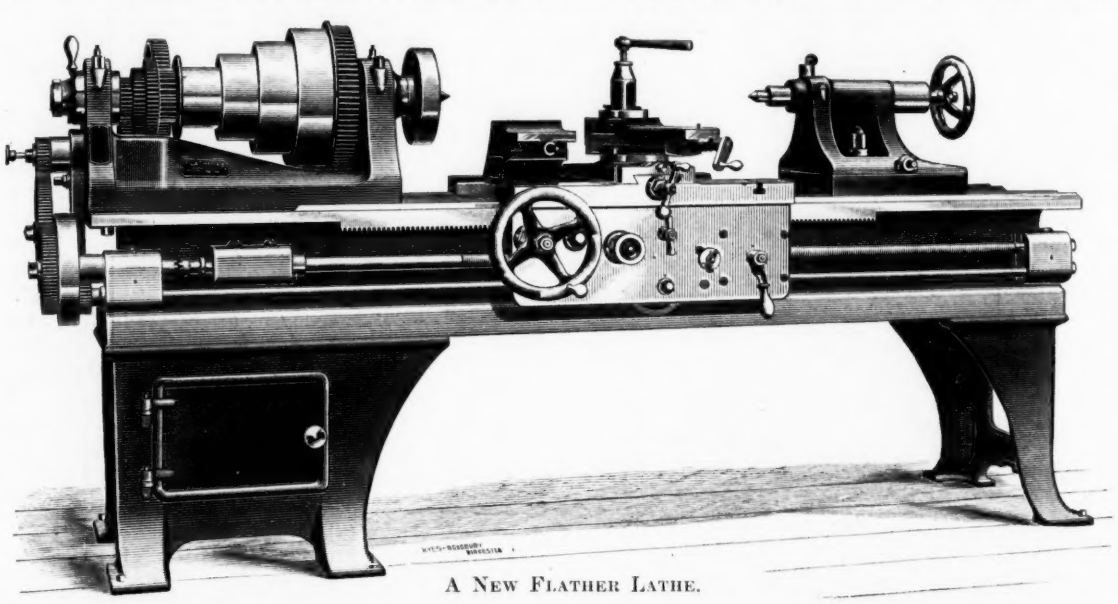
Sand-papering Machine.

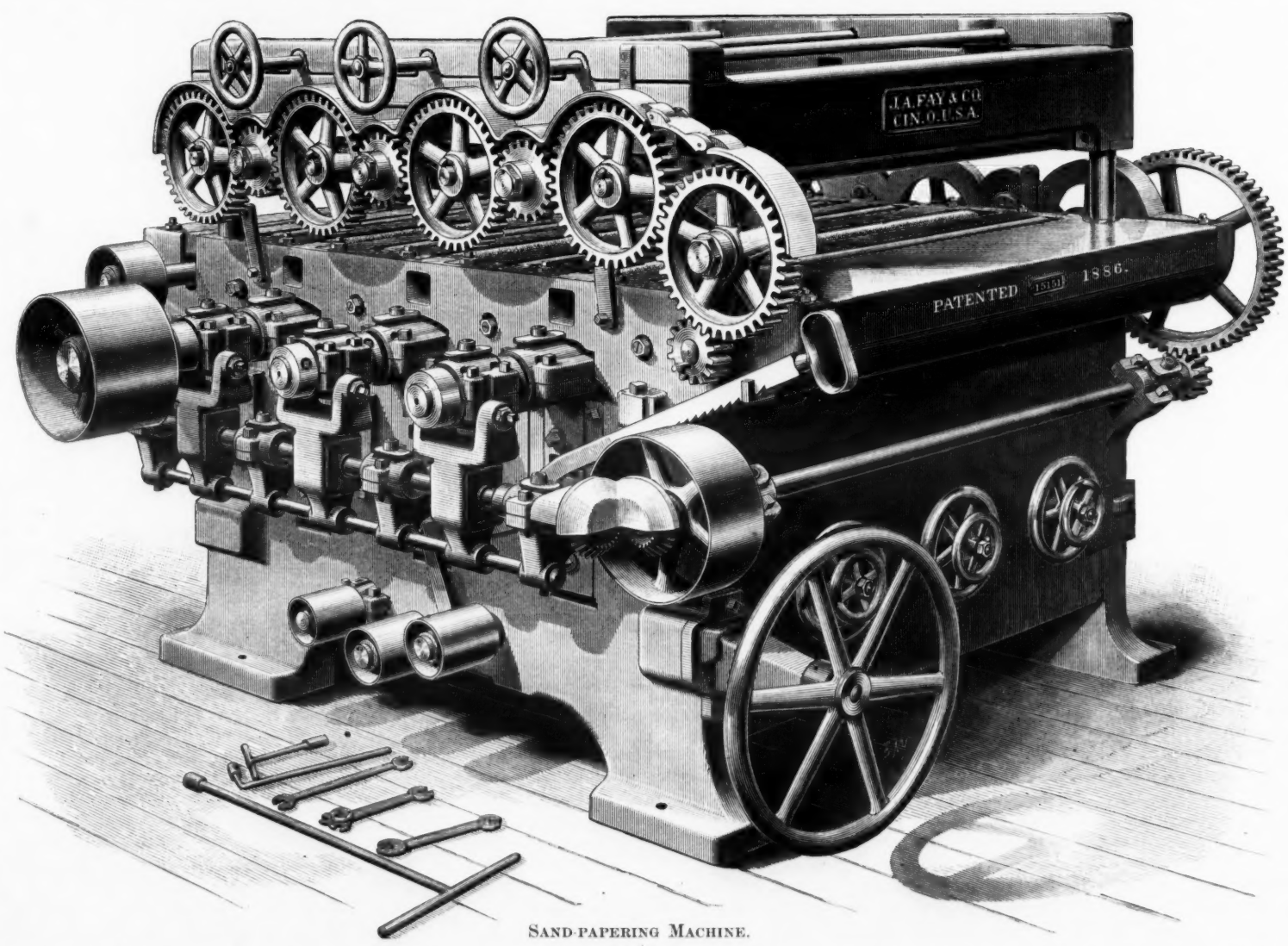
We give on this page an illustration of a sand-papering machine which is, so far as we know, the most elaborate and complete machine yet built for this purpose. It is called a triple-drum machine, for the reason that the sand-paper is stretched over three drums, which revolve at high speed within the platen, the first of these drums carrying paper of coarse grade and the others successively finer grades; that on the third being sufficiently fine to give any desired degree of finish or polish to the surface.

To prevent the formation of lines running along the work, as would be the case were the drums given a plain rotary motion, they are also given a reciprocating motion endwise, this being effected by means of the short levers seen at the front of the machine, which are pivoted at their lower ends, and are moved by eccentrics on the shaft, which is driven by the miter gears. The drums and the shafts upon which they are run are of steel, the latter being $2\frac{1}{16}$" diameter, revolving in bearings which are gibbed to the frame in such a way that the drums may be adjusted vertically, both ends together or separately, as may be desired, this adjustment being made by means of the small hand-wheels seen at the right of the machine.

Within the platen there are also four feed rolls placed so that one is on either side of each drum, directly above these rolls being four others, which are supported in the upper frame seen above the platen, this frame being adjustable vertically by means of four screws, one at each corner of the machine. These screws rest on anti-friction rollers, and are moved by the large hand-wheel near the floor. The upper and lower rolls can be separated from each other sufficiently to admit work 8" thick. All the feed rolls are driven by the train of expansion gearing shown, all the feed mechanism being so designed as to give a very strong and steady feed. It is governed by a double belt tightener, operated by a hand-lever by which it is instantly stopped or started. In the upper frame there are three pressure rolls placed one above each drum, to hold the work firmly to them, these rolls being adjustable vertically by means of the small hand-wheels seen above the gear train. There is also a brush attachment which cleans all dust from the work as it leaves the machine. The countershaft may be placed either on the floor or below it, as desired. The machine is built for handling work of various widths from 24" to 60", by J. A. Fay & Co., Cincinnati, Ohio.



A NEW FLATHER LATHE.



SAND-PAPERING MACHINE.

A New "Flather" Lathe.

The first illustration on this page represents a new 22 inch lathe, which has been brought out by Flather & Co. The distinctively new feature of the lathe is in the arrangement of the train of gears and other mechanism for feeding, there being on the main spindle, at the rear of the cone pulley, three gears of different diameters, which are keyed to the spindle, and drive three other gears which run loosely on the stud spindle below. There is a sliding key by which any one of these gears can be connected to the stud, this key being moved from one gear to another by means of the sliding pin which passes through the center of the stud and is provided with a knob at its outer end. Thus, by adjusting this knob, which can be done while the lathe is running, three different rates of feed are obtained, which are proportioned to each other as 2, 4 and 8, and the lathe consequently has virtually three lead screws of corresponding pitches, and three different threads can be cut by one set of change gears. Of course we are aware that this principle has been used before, but in this instance it is so applied that the length of the stud beyond its supporting box is not increased, but rather shortened, which, of course, is desirable, and one effect of placing the gears inside the head is to further separate the main bearings and lengthen the spindle, which is also desirable. It will be noticed that the usual feed cone pulley has been dispensed with, and plain pulleys are used for a comparatively wide belt, the motion derived either from

this belt or from the change gears being imparted to a short shaft, to which the lead screw may be connected or disconnected by a sliding interlocking clutch, while the feed rod can also be connected or disconnected by means of a small sliding gear. The feed is reversed in the apron, and the necessity for cutting away the web of the head-stock to admit the reversing lever thus done away with. The screw cutting and friction feeds cannot both be engaged at the same time.

The box leg under the head of the lathe is also of new design, since it does not come down to the floor all around, but rests at its four corners only, the main advantage claimed for this being that the lathe can be moved and leveled up more easily than with the usual form.

The spindle is of crucible steel, with bearings ground true; has a hole through it 1¾″ diameter; runs in hard composition boxes which are so made that new ones can readily be supplied which will restore the alignment, and is threaded at the end for the face-plate in such a way that a plain bearing is left for the hub of the plate, which extends for about half the length of the nose, the plates being bored to fit this tightly, while the thread is fitted loosely, so that the plain portion, which is larger in diameter than the screw, centers and holds the plate true. The front bearing of the spindle is 3¼″ diameter, 5″ long; rear bearing, 2½″ diameter, 3¼″ long. The cone pulley is for a 3¼″ belt, and the largest step is 14″ diameter.

The foot-stock is adjusted laterally by a single screw, which is provided with means for taking up all lost motion due to wear, and there is an index which is convenient for setting the center over to any required distance.

The general design and proportions of the lathe are well shown by the engraving, and call for no further comment. Hill, Clarke & Co., Boston, Mass., are the general sales agents.

Parallel Motions.

BY PROF. A. MACLAY, GLASGOW, SCOTLAND.

FOURTH PAPER.

(7)—ELLIPTIC PARALLEL MOTIONS.

Example 11.—*To draw a slider crank elliptic parallel motion, having three points with strokes* S_1, S_2 and S_3.

Referring to Fig. 11, G is a slide block movable in the straight line $X\,X$ between guides, $F\,G^1$, a swinging link centered on the slide block G^1, and connected to a fixed center A by a radial link $A\,C$. The points A and C can be so chosen that a point F in the link $F\,G^1$ will move very approximately in a straight line, through a limited range of motion $F\,F_1 = S_2$, and by the imposition of an internal parallelogram $B\,C\,D\,E$ a second point E can be found, which will move in a parallel line with the reduced range $E\,E_1 = S_1$, or of the external parallelogram $F\,H\,I\,C$, a third point G can be similarly found, which will copy the path of F with the greater range $G\,G_1 = S_3$.

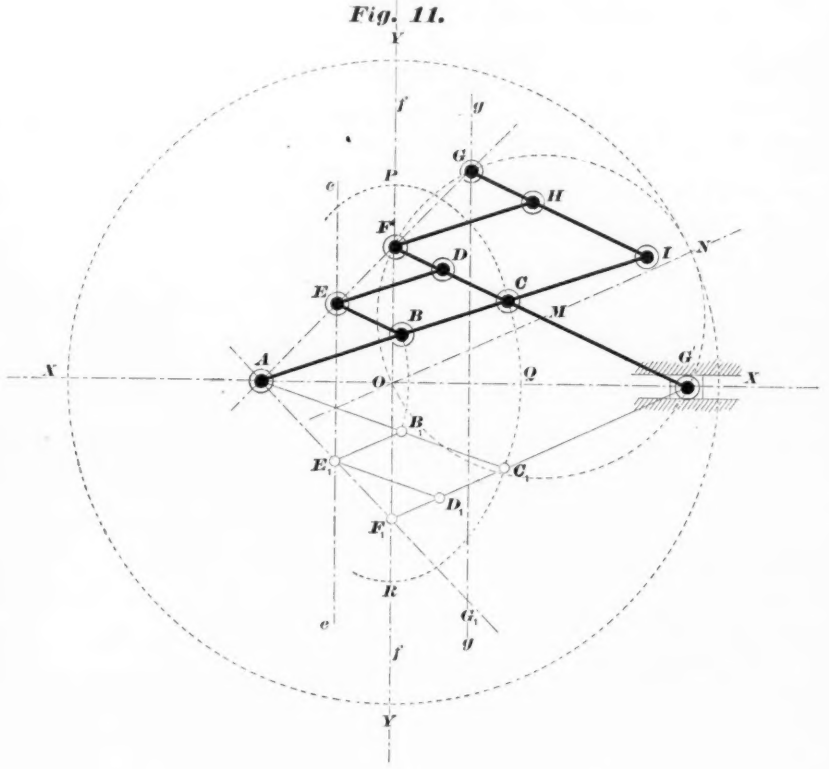
The proportions can be easily determined as an application of the well-known geometrical principle that *the hypocycloid described by a point on a rolling circle is a straight line when the rolling circle is half the diameter of the guiding circle.*

Let it be required to design a slider crank parallel motion, and suppose that three points E, F and G belonging to it are to move in parallel straight lines with strokes say $S_1 = 2'\ 8''$; $S_2 = 4'\ 7''$; $S_3 = 7'\ 2''$. Scale $\frac{1}{12}$. Draw two straight lines $X\ X$, $Y\ Y$ at right angles to each other, intersecting at the point O. Let F be the guided point, having the stroke S_2. Measure off along $Y\ Y$ to each side of $X\,X$, $O\,F = O\,F_1 = \frac{1}{2}S_2$. Through F draw a line $F\,G^1$ at an inclination not exceeding 25° to the horizontal, intersecting line $X\,X$ at G^1. Upon $F\,G^1$ as a diameter, describe a circle $O\,F\,N$, with center M. With O as center, radius $O\,N$, describe the circle $Y\,N\,Y$. Then if the circle $O\,F\,N$ be supposed to roll within the circle $Y\,N\,Y$, points F and G^1 on the circumference of O $F\,N$ will move along the diameters $X\,X$ and $Y\,Y$ of the guiding circle $Y\,N\,Y$, and any intermediate point C on the line $F\,G^1$ will describe an elliptic path such as $P\,Q\,R$. Join $F_1\,G^1$ and mark off $G^1\,C_1 = G^1\,C$; also make $O\,Q = F\,C = F_1\,C_1$. Next find A, the center of a circle passing through $C\,Q\,C_1$. Then A is the required fixed center, and $A\,C$ the radial link, which will cause the point F of the link $F\,G^1$ to move in the straight line $Y\,Y$, with a range of motion $F\,F_1$ equal to the given stroke S_2.

Note that the point C might have been chosen anywhere on the line $F\,G^1$. But the nearer it is taken to the end F, the flatter does the elliptic path become, and consequently the longer does the link $A\,C$ require to be to give the proper radius of curvature for the arc $C\,Q\,C_1$. On the other hand, the nearer point C is taken to the end G^1, the shorter is the link $A\,C$, and the more restricted is the range of motion of the point F to get a good approximation to the straight line $Y\,Y$. It is, therefore, generally more convenient to assume the point C somewhere on the middle part of the line $F\,G^1$. When it is chosen exactly midway between F and G, we have then the particular case of the slider crank known as the *Scott-Russell, or grasshopper parallel motion.* The path of the point C is then a circle, and the center is at O. Then $A\,C = F\,C = C\,G^1$. Further, the path of the point F is then not only approximately straight, it is exact, and its range of motion may then be the entire diameter of the guiding circle $Y\,N\,Y$.

In Fig. 11 C is assumed at a point two-fifths of $F\,G^1$ from F. Beyond the 25° limit it will be noticed that the discrepancy between the circle $C\,Q\,C_1$ and the ellipse $P\,Q\,R$ rapidly increases. The range of the motion of F may not therefore be carried further without serious departure from the straight line path.

Fig. 11.



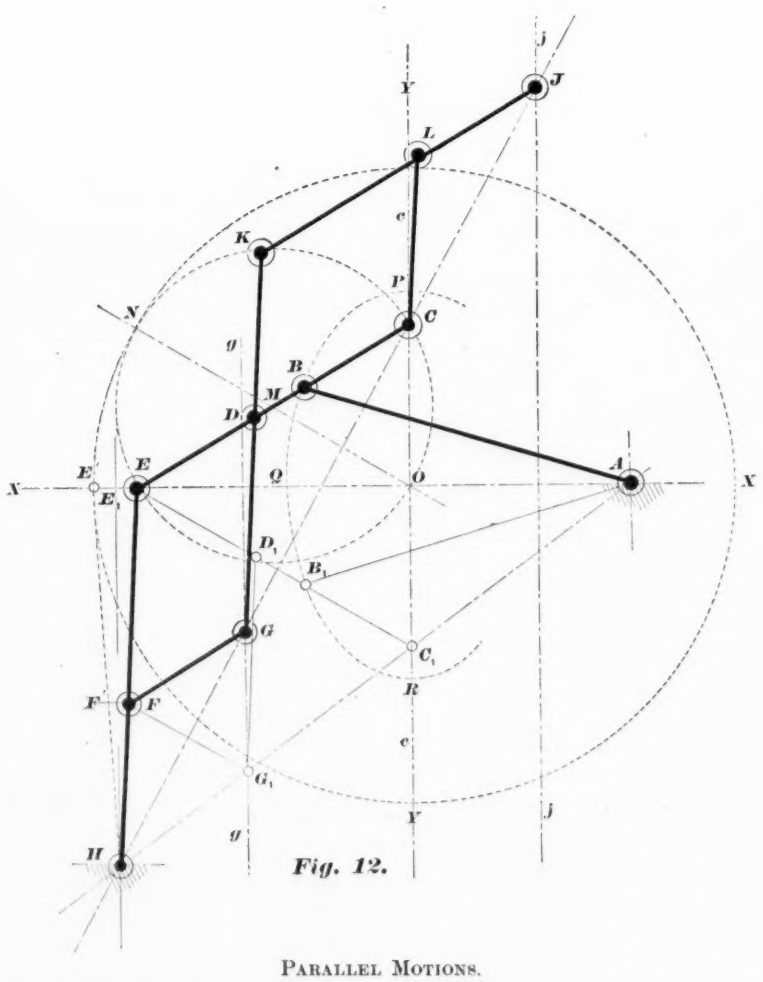


Fig. 12.

PARALLEL MOTIONS.

For point E with stroke S_1, draw a line through A and F. Determine a point E in $A\ F$, such that $A\ E : A\ F :: S_1 : S_2$, and through E draw $E\ B$ parallel to $F\ G^1$, and $E\ D$ parallel to $A\ C$. Then E is the required point. Again, for the third point to move in a parallel line with stroke S_3, determine a point G on the line $A\ F$ produced such that $A\ G : A\ F :: S_3 : S_2$. Then through G draw $G\ H$ parallel to $F\ G^1$ to meet $A\ C$ produced at I, and through F draw $F\ H$ parallel to $A\ C$. Then G is the third required point. Show by drawing the complete mechanism in several positions that the centers E, F and G move in the parallel lines $e\ e$, $f\ f$ and $g\ g$, with strokes $E\ E_1 = S_1$; $F\ F^1 = S_2$, and $G\ G_1 = S_3$ respectively.

Example 12.—*To draw a quadric crank elliptic parallel motion, having three points with strokes* S_1, S_2 *and* S_3. $A\ B$ and $H\ E$, Fig. 12, are swinging links centered at A and H respectively, $E\ B$ a coupler prolonged beyond B to a point C. If the proportions be properly taken the point C may be made to describe an approximate straight line through a limited range of motion $C\ C_1$. By the addition of the parallel links $F\ G$ and $G\ D$ a point G is obtained, which copies the motion of C on a reduced scale in the proportion of $H\ G$ to $H\ C$. Similarly, by extending the link $G\ D$ upwards to K, and adding the links $C\ L$ and $K\ J$, a point J may be made to copy the motion of the point C on an enlarged scale in the proportion of $H\ J$ to $H\ C$.

The proportions may be determined by the same geometrical considerations as in the case of the slider crank elliptic parallel motion of Example 11, viz., by approximating to the elliptic path of one point by a circular arc, and further in this case by approximating to the straight line hypocycloid of a second point by a circular arc.

Let it be required to design a quadric crank elliptic parallel motion, of which three points shall move with given strokes, say $S_1 = 2'\ 8''$, $S_2 = 6'\ 1\frac{1}{2}''$, $S_3 = 8'\ 10''$ respectively. Scale, $\frac{1}{12}$.

Let the guided point be the middle joint C with stroke S_2.

Draw the horizontal center line $X\,X$, and at right angles to it the line $Y\,Y$ intersecting $X\,X$ at O. From O along $Y\,Y$ measure off each way $O\,C = O\,C_1 = \frac{1}{2}S_2$. Through C draw $C\,E$ at an inclination to the horizontal not exceeding 25°, intersecting $X\,X$ at E. Upon $C\,E$ as diameter describe a circle $E\,O\,C$ from center M. From center O with radius $C\,E$ describe a circle $Y\,N\,X$. Then if circle $E\,O\,C$ be made to roll upon circle $Y\,N\,X$, the points C and E upon the circumferance of $E\ O\ C$ will move in the straight lines $Y\ Y$ and $X\,X$ respectively, the center M will describe a circle of radius $M\ O$; any point between M and C will move in an ellipse whose major axis coincides with $Y\ Y$, and any point between M and E will move in an ellipse whose major axis coincides with $X\ X$. Suppose B to be taken at $\frac{2}{3}\ C\ E$ from C. Then its path is shown by the ellipse $P\ Q\ R$.

Join $E\ C_1$ and mark off $E\ B_1 = E\ B$. From O measure off $O\ E^1 = C\ E$, and $O\ Q = C\ B$. Then find A, the center of a circle passing through $B\ Q\ B_1$, and join $A\ B$. When the point C is at O, E will be at E^1. $E\ E^1$ then represents the complete range of motion of the center of joint E. Join $E\ E^1$ and bisect it by the line $E_1\ H$, and intersect it at H by a line through A and C_1. Then $H\ E$ may be taken as a minimum length for the swinging link attached to the end E of the coupler $C\ E$. But it is evident that the longer the link $E\ H$ is made, the nearer will be the approximation between the arc $E\ E^1$ and the straight line $E\ E^1$. Next for the internal point with stroke S_1. Join $H\ C$, and on it find a point G such that $H\ G : H\ C :: S_1 : S_2$. Then through G draw $G\ F$ parallel to $C\ E$, and $G\ D$ parallel to $H\ E$. Similarly for the external point with stroke S_3 produce $H\ C$, and find a point J on it, such that $H\ J : H\ C :: S_3 : S_2$. Through J draw $J\ K$ parallel to $E\ C$, meeting $G\ D$ produced in K, and a parallel to $G\ K$ through C in L. Then show, by drawing the mechanism in a series of positions, that the three points G, C and J move in the parallel lines $g\ g$, $c\ c$ and $j\ j$, with the given strokes S_1, S_2 and S_3 respectively.

John Wiley & Sons, 53 East Tenth street, announce that they have now in preparation "Modern Locomotive Construction," by J. G. A. Meyer. Mr. Meyer prepared a series of articles on this subject for the AMERICAN MACHINIST, but these articles have been revised, and much new matter and cuts have been added. It will be a standard work on the subject treated.

Electric Motor Gearing.

The cog-wheel of which we give a side view, partly in section, in Fig. 1, and a sectional plan view in Fig. 2, is designed for electric railway service, and it is said that, with its use, excessive wear and tear, due largely to high pitch velocity, is avoided, and smooth and noiseless running obtained.

The construction is plainly shown in the illustration. The body of the wheel *A* is keyed to the shaft *B* by an ordinary key *b*, fitting into keyways both in the wheel and in the shaft. Opposite to this keyway is a slot *a*, in which is inserted a block *C*, of wood or other material that will take up the ringing sound of the wheel and deaden the noise. This block is held by a bolt C^1, which also serves to draw the wheel tightly upon the shaft, causing the wheel to be held not only by the key, but also by friction. This gives all the advantages of an interchangeable rim, and facilitates its removal from the shaft.

The rim of the wheel has a series of pockets *d*, each pocket having a double-taper, one portion d^1 of the pocket tapering inward, and the other portion d^2, at the base of the pocket, tapering in the opposite direction, forming an undercut section, in which the cog is expanded. The partitions forming the pockets are tied together at their bases by the band a^1, so as to prevent the partitions from springing when the cogs are driven in and expanded. The shanks *e* of the cogs *D* are tapered to fit the pockets at d^1.

Holes *i* are drilled through the flanges of the rim, and the shank of each cog is slotted at the base, as shown in Fig. 1, the slot coming in line with the holes *i*. Through these holes, and in the slotted portion of the cog, is driven a pin *f*, which expands the base portion of the shank of the cog into the under portion of the pocket, thus firmly locking it to the flanges of the rim. For the purpose of guiding the pin *f*, transverse grooves are cut in the side walls of the slot in the cog, and these grooves are, of course, in line with the holes *i*, when it has been driven into position. This construction affords easy means of casting the arms to the rim and hub, as shown, making a clean and symmetrical wheel. The cogs are very firmly held in position; but, when necessary, any one of them can be readily removed and replaced, by simply driving out its pin *f*. Or when worn out, a new set of cogs can be driven by an ordinary mechanic, and trimmed with a chisel; or a special machine for this purpose will be furnished on application. The cogs are impervious to water and oil, are not affected by heat or cold, and may be run without lubrication.

These gears are constructed to mesh into cast-iron or cast-steel pinions, case-hardened. Special pinions of composition are furnished when so ordered.

If the cogs on the pinion and wheel are made of the same material, the former will wear much faster than the latter, because, if a given number of teeth in the pinion would last four months, transmitting a given power, it is reasonable to presume that the larger wheel, with four times as many cogs, would last four times as long. Hence, making the cogs in the wheel of softer material than those on the pinion, the wear is equalized, and the cost of repairs reduced.

These wheels are also made in two parts, thoroughly fitted and bolted up by reamed bolts, bored and keywayed to fit standard axles, or as may be ordered.

They are said to last from 12 to 18 months, and the pinions will last from 6 to 12 months, according to the condition of the service.

Leonard Atwood, Bridgeport, Conn., is the inventor and patentee.

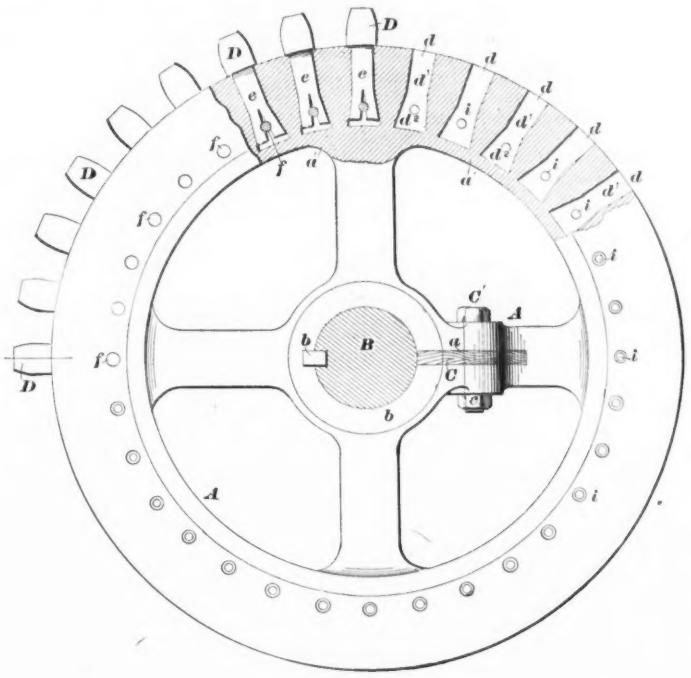


Fig. 1.

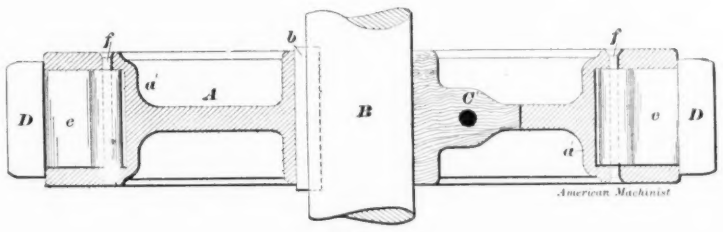


Fig. 2.

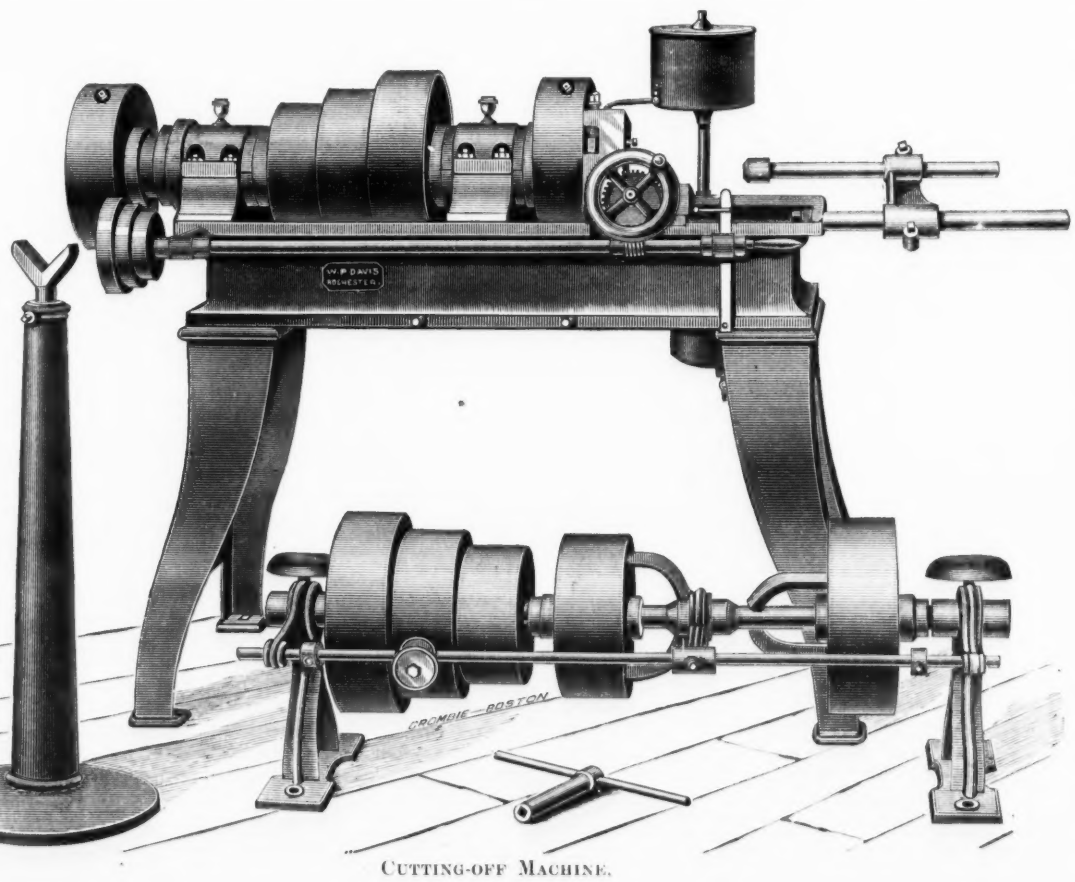
ELECTRIC MOTOR GEARING.

Cutting-off Machine.

We illustrate herewith a machine for cutting off stock, which has recently been brought out by W. P. Davis, of Rochester, N. Y.

There is a powerful chuck at each end of the spindle, and the tool holder and slide are adapted for the severest service to which such a machine is likely to be subjected.

There is an automatic feed which is automatically released, and there are two speeds to the countershaft, so that as the tool approaches the center of the work the speed can be increased by throwing the shifter. The length gauge is provided with a finger which can be swung out of the way after the piece is gauged. The adjustable stand is for the support of long bars. The machine shown is for stock up to 2½″ diameter, and there is a larger size made for stock up to 4½″ diameter.



CUTTING-OFF MACHINE.

Automatic Mail Delivery.

An invention which is exciting a good deal of interest on the continent, where the flat system of residence is so much in vogue, is an automatic electric letter and parcel deliverer, produced by a resident of Geneva. As its name implies, the apparatus is designed to distribute automatically on each floor, and to all the tenants of a house, the letters or parcels which may be addressed to them. A large box situated on the ground floor contains as many apertures as there are floors or tenants in the house. When a letter or other object is introduced into one of these openings, the box rises, and, in passing, distributes in each of the receptacles fixed in the antechamber of the addresses, articles intended for them, each tenant being in turn advised of the arrival of the article by the ringing of an electric bell.

The working of the apparatus is extremely simple, as the following few details will show, and its cost is insignificant. The object introduced into the box on the ground floor effects, at the top of the house, an electric contact, which opens the valve of a water tank. The water fills a cylinder, which serves as a counterpoise, and raises the letter-box, which, while in the act of passing each private box, opens itself by an ingenious yet simple mechanical arrangement, and deposits the respective contents therein. When the carrier box has arrived at the top floor, the cylinder empties itself, and the box descends to its place, and is ready for another trip.—*Iron.*

Hammering Saws.

BY C. E. GRANDY.

Barring all mishaps to circular log saws, the natural work, so to speak, tends to change the tension from the edge to the center, so that in time, according to stress, the saw becomes too large on the edge or rim; this is held to the same diameter by the center size, and as there is a surplus of ridge it buckles or kinks, and, as before said, runs "snaky." To restore the tension so that the plate is true, and the tension is again equal throughout, is the subject of this paper.

First of all some kinds of tools suitable for the purpose must be had. These consist of a hammer, a straight-edge, and a hard, smooth-faced anvil. To go at it systematically, lay the saw out in circles by revolving it on the mandrel, and holding a piece of white chalk against the plate. The first circle should be one-third the distance from center to rim, both sides alike, then five more circles about one inch apart towards the rim, both sides; then, with a straight-edge for a ruler, place it at point of the saw tooth and at center of saw. Draw radiating lines across the circular lines, one line for every tooth. Then place the saw flat on the anvil, supported by a bench or an attendant. Place the intersections of the line first near the center on the highest part of the anvil, then with a dog-head hammer weighing, for large saws, six pounds, strike a blow the weight of the hammer, and some more. Do this on all the intersections of lines, both sides, then test the saw with the straight-edge held at right angles with the support, with the saw laid flat, one edge lifted about four inches high. If you have not dished the saw it will drop near the center about $\frac{1}{16}$ inch. This will do for a speed of 700 or 800 revolutions, but if the saw does not drop, but yet remains crowning, go over the lines again, both sides alike. The amount you have to do in this respect depends entirely on the temper of the saw. Some will drop with but little work, while others have to be hammered for two hours or more, but hammer it till it drops sure, at center and parallel to about two-thirds of the diameter of the saw. When you have done this you have got to true up the plate. A good, large hard-wood block of oak or maple will do for this. Hang the saw

loose on a pin or bolt driven into a post, or on a mandrel if you prefer, but do not screw up the nut. Test the saw with a short straight-edge for high places, and chalk them with an X. Work carefully and closely, then lay the saw down on the block, high places up, and force them down with the hammer by blows delivered lightly on all the marked places, then test again. Continue this until the plate is level, then test with a long straight-edge for a true plane. The saw may be dished to log or reverse; when this is the case you must go over it with a hammer on the wood block, striking scattering but uniform blows, lightly, and test often with the long straight-edge; do this until the saw is flat or in a true plane generally. Then again use the short straight-edge, testing for high places, and mark as before, forcing down flat, pretty much as you would straighten a piece of crooked iron.

Pening or stretching the concaved side is all wrong. It has been taught in books, but I think it was done to mislead, for it is impossible to fetch up the hollow or concaved side in this way on a saw plate.

In truing the plate it sometimes occurs that the bend is in the form of a ridge extending in the same direction longitudinally. On such a ridge the twist pene is best. For convenience the pene is twisted to 45° with the handle; the other pene is reversed, so that, as the saw lies, if the ridge runs one way use one pene, if the other way use the other pene, striking blows that are parallel with the ridge. I will not here explain why this is better, but it is so.

Sometimes the saw has been run foul and bent; this is the case many times with cutting-off saws, by the cant becoming swung round by pinching the saw. When the saw is bent in this way, hold it level with the eye and sight across the plate; you will at once note the bend. Mark the convex side and strike blows with the twist pene in the direction of the line of the highest place, be it circular or straight. It should then be tested for tension, and corrected as before stated. It is much better to get a good set of tools, which can be had for about twelve to fifteen dollars; then you can work, for you have tools to work with.

Rathite.

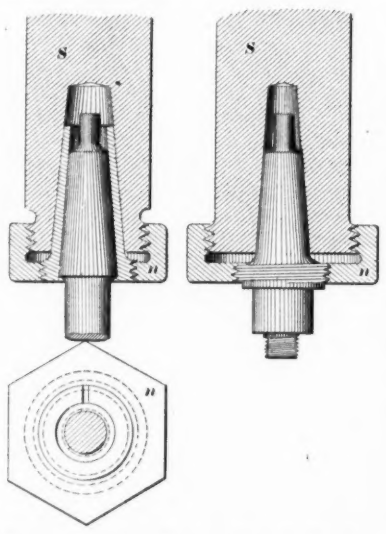
This name has been given to a new description of rubber made by Messrs. Waddington, Rath & Co., Spring Bank Mills, Hyde. For many purposes pure rubber is unsuitable, being too elastic. For instance, it is found that railway buffers, if made of the pure article, are too soft to withstand the great crushing force often brought against them in use. Cycle tires, also, if too elastic, are apt to stretch off the rim of the wheel, in spite of all attempts to fasten them by means of cement. The usual mode of counteracting the superabundant elasticity of rubber goods, and at the same time reduce the cost of production (the latter point frequently being the most important), is to add mineral powders, such as chalk or metallic oxides, litharge, zinc, etc. The new material is said to consist of pure rubber (combined with the usual proportion of sulphur to effect vulcanization) and silk fiber in a finely divided state. The result is an article which appears well adapted for all purposes where toughness and durability are desired rather than very great elasticity. —*Industries.*

Manual Education.

Mayor Cleveland, of Jersey City, has sent the following communication to the Board of Education:

Some of you are aware that I have for a long time contended for a more practical education in our public schools—an education which would enable the scholars to work their own way in the world, if need be, when they leave the school; that would make them more useful members of the community, more independent and self-reliant in their immediate surroundings, and so cause them to become more valuable citizens of the State. That is the purpose for which money is raised to support the public schools. Next to personal independence, the glory of the several States that compose this great republic is in their public school system; but we must not lull ourselves to sleep with the popular idea that our system in Jersey City is perfect. It must be remembered that this is a world of progress, and that what does not progress will fall behind.

While we have been struggling with the problem of how to provide for the absolute needs of our city government, we have not kept in touch with the public school systems of other cities. We have been content to provide as well as we could for the old method, and have allowed other cities to move on far beyond us in their march for a more practical education. They teach their girls to do useful things. They teach their boys the use of the saw and hammer, the chisel and plane, the square and compass, the plumb line and level, and thus they teach the application of mathematics to the useful arts. The girl can do something, and the boy can make use of his own hands in a way to aid him in any position in life, whether in learning a trade, following a profession, or pursuing any calling or business after leaving school.



Fastening for Taper Shank Tools.

The accompanying engravings show an improved fastening for taper shank tools which has been introduced, and for some time used in England, having originated in the establishment of the well-known Manchester machine tool builders, Alfred Muir & Sons.

Our engravings show the device in two forms—the section at the right showing it as arranged for holding the shanks of milling cutters, or arbors, etc., while that on the left shows its application to standard taper shank drills, taken as they are found in the market.

Referring to the first-named arrangement, it will be seen that the spindle of the machine (*S*) is threaded near its outer end for a nut *n*, this nut being also threaded for the shank of the tool as shown, the two threads being both right or left-hand, as the case may be, but that on the shank of the tool being of finer pitch than that on the spindle. The result of this arrangement is that the shank is drawn into the spindle with what is in effect a differential screw, and any tendency to slip only draws it tighter, while by the great force obtainable the tool is readily forced out by turning the nut the reverse direction by a wrench; no keys being used.

Where the device is adapted to twist drills or other tools on which it is not practicable or desirable to cut threads, a split sleeve or collet is used, on which the thread is cut, this collet being bored to standard "Morse" or other taper, and split as shown, the gripping force being very great.

It is intended, of course, to have the threads so fitted as to leave the tapered portion of the bearing to center and true the tool, Whitworth threads being used in England, though it seems probable to us that buttress threads would give better results than those of any other form, since they would have little or no tendency to spring the shank out of true, and are easily fitted. It will be seen, we think, that for many machine tools this device would possess merits not found in most other forms of fastenings. It is being introduced in this country by Mr. Gus. C. Henning, Temple court, New York City.

Some Rolling-mill Notes.

By C. O. Sine.

Our engineers have been spoken of in a former letter in a general way; since then, incidents have occurred that prompt me to select them as an initial for this letter, in which some of them will be individualized.

Before reaching the blast furnace the other day I noticed by the exhaust of the engine that it was running faster than usual, and, by counting the exhausts, found it to be running 50 revolutions per minute, while 40 to 45 is the speed it usually runs.

On my arrival at the furnace I inquired of the engineer why he was running so fast. His reply was that the furnaceman had ordered him to do so, as the furnace was "sick," and required that kind of treatment, which would cure it in a few hours, when he would slow down again.

I remarked that the engine was running 50—two or three revolutions faster than I had ever known it to run.

He looked up, and asked how I knew the engine was making 50 revolutions.

I replied that I had counted the exhausts as soon as I was within hearing.

"Well," he said, "I had guessed pretty close, but no one could tell how fast an engine run by counting the exhausts."

My experience here has been such that I can listen to any kind of a story without exhibiting surprise, or in the least losing my temper, even when untruthful, to cover up carelessness or unreasonable as this was, so I simply asked him to explain why I could not; to which he replied that the engine made more than one exhaust to a revolution. He appeared to be willing to furnish information of this kind, so after a few questions ostensibly for information on this subject, I was able to satisfy myself that this engineer did not know whether his engine made two, three or four exhausts to a revolution.

He had run this engine for five or six years, and had always done his work satisfactorily. Beside stopping, starting, packing, etc., that are always included in an engineer's duties, he does the furnace blacksmithing, such as sharpening bars, picks and other tools for the furnace. He has but little to do, so far as the boilers are concerned, for they are fired with gas, and the fireman tends the water in the boilers. If anything goes wrong he sends to the machine shop for assistance.

I had known for a long time that he was not what would be called a bright engineer, but he was always careful and industrious, and no questions were asked as to his ability to perform duties not required of him. I had a curiosity to know how he had acquired his title, so I made inquiry among those who had known him much longer than I had, and found that he had been a coal miner; but the numerous strikes and general hard times in this branch of industry had forced him to seek some other kind of employment. He first got a job firing in the neighborhood of the mine, and burnt all the coal he could in order to bring the coal operators to time, but his efforts in this respect were not successful. He got credit for being industrious (even though he had a bad motive), careful and obliging, and being always ready to exchange the shovel for the throttle, he finally made the exchange permanent. Later on, there was a vacancy at our furnace; it paid better than where he was, so he applied for the job, and got it, and has been an engineer ever since. He has learned by tact and observation to do all that is usually required of an engineer, but, if asked to stand an examination, I have no doubt but the result would be very unfavorable.

I have no desire to argue the question, or decide whether he is an engineer or not, but will contrast him with an engineer in the mills, who has acquired his title in a more regular way—has received instructions, as it were; he has had opportunities to learn, and has improved them to some extent. He can figure a weighted safety valve, and answer almost any question about pumps or injectors that an examiner could ask. He is well posted in setting valves, and although not an expert with the indicator, he knows fairly well how to read one, and how to take it. He too is industrious, and does his work well—even gets enthusiastic at times. I will relate an instance:

He sent for me the other Saturday afternoon to see how tight the piston packing was in the big engine, after a run of nearly a year without touching. He had the cylinder head off, and asked me to look at the packing, while he would let the steam in behind the piston. The piston was near the far end of the cylinder, and as he let the steam on the engine started, and the piston proved to be tight the whole length of the stroke, scarcely enough steam and water passing it to be seen. The valves were equally tight. He continued to admit steam behind the piston to the end of the stroke, and then exhaust it till the engine got up nearly to its usual speed, then, without saying a word, and contrary to any expectations I had, he let the steam follow the piston, and left the exhaust valve closed on the return stroke to see what effect a very high pressure would have on the piston, knowing that it would cushion on a cylinder full of steam at 50 pounds. As soon as I realized what he had done, I got away from the front of that piston, and helped him to get the exhaust valve open as soon as possible, but not till the return stroke was completed. This experiment resulted in straining the cylinder head bolts so the joint leaked badly, and loosened up both ends of the connecting rod, but did no material damage that we could find. I am not positive whether the packing leaked under the pressure or not. I had no curiosity to look at it under such pressure, nor do I think that this engineer would have now, for it is possible to get up such cushion pressure as to part the connection somewhere between the crank-pin and piston head. It is, of course, possible to construct engines with relief valve so that no dangerous pressure can be had. The engineer's only object in this experiment was to see if the piston would be tight under very high pressure, and he was oblivious to everything else.

I asked him how much pressure he thought he could get that way, and he said he expected some 500 pounds. After a moment's reflection it began to dawn on him that he had made a mistake, that the engine was not designed for such pressure, and that if he had not forgotten to close the cylinder cocks (in this case an inch-and-a-quarter globe valve) things might have been much worse.

Before leaving this subject I will say that this same mistake is made by engineers often in stopping an engine, and is a practice known among our engineers by the name of "plugging." There ought not to be any injury done to an engine by applying boiler pressure to either side of the piston at any time, but the careless and indiscriminate use of the starting bar is pernicious and wholly unnecessary, except, of course, when to stop quickly is of the greatest importance, as in case of an accident. This does not imply that carelessness is ever called for as any of an engineer's qualifications.

There is another engineer employed at a neighboring plant, whom I have become acquainted with during the past year, that I will speak of. His employment now will scarcely warrant calling him an engineer, for he only runs a pump, but he has had situations of much greater responsibility, and, for anything I can infer from his conversation, he is well qualified to hold any engineer's job there is in town. It appeared to me that his ambition was to be well informed on anything pertaining to stationary engineering; not only this, but he was educated in many ways far above the average engineer. Why he is not holding a better position is to be accounted for through a lack of self confidence, or the accomplishment of pleasing his superiors socially. This is important, especially when being employed by some non-practical management. For instance, the secretary of the company has concluded that it is time to air his bump of economy, and give it an opportunity to grow and assume such proportions

that it shall be everywhere visible to the board of directors. For this purpose the secretary asked the engineer if he could not pump the water into the boiler hotter and save coal, and other like questions, till the engineer gets out of patience and tells the secretary if his work is not satisfactory to get another man. Now, the secretary had no intention of offending the engineer, but says to himself, his work is not satisfactory, for he does not care to practice economy. From this time the engineer begins to look for another job, and the secretary lays the plans for securing another engineer.

On the other hand, how easy it would have been for the engineer to have taken an interest in giving the secretary the same courtesies, answer his questions, and explaining to him with the same cheerfulness his several schemes of economy, one of which was to purchase a thermometer at his own expense, whereby he could determine the temperature of his feed water and escaping gases from the boiler to the chimney, with which he could experiment with more satisfaction to himself, and greater economy for the company, the same as he had done to every gentlemanly visitor that called on him.

Under the circumstances, the secretary, may be, went away not wholly pleased with his undertaking, for the engineer had hopelessly hobbled his hobby right in the start, but the probability of the secretary troubling the engineer on that subject again is faint indeed, and the probability that he will advocate his removal is fainter still.

In contrast with this conduct on the part of the engineer, it would be quite within the province of an incompetent engineer to please the secretary by pretending to act on his suggestions, and send in reports to correspond with what he thought the secretary's opinion would be. This, of course, will please the secretary, and help to make the engineer "solid," at least with the secretary, but it is a practice that can't be too strongly censured. On the other hand, a little politeness and a pleasant disposition is of real value to any one who is employed, and wishes to be a success; nor does he compromise his manhood by so doing, no difference whether he holds a high or low position.

A Girl Navigator.

A girl of 18 years, the daughter of a sea captain, recently navigated her father's ship when he and all the crew were down with the yellow fever. The bark, a coasting vessel, bound from South America to Savannah, was last spoken at sea off Navassa, when all hands were reported ill with yellow fever, and no attempt was made by the vessel which reported her to give any assistance. The master of the bark had with him on board his only daughter, who appears to have been the last to catch the fever. With the aid of one or two sailors who managed to crawl to the deck, she navigated the vessel for several hundreds of miles, and succeeded in reaching port with a crew dead and dying, and the captain in a critical condition.

A Pittsburgh dispatch to the *Evening Post* says: "The Greenleaf & Forst oil well, in the McDonald field, Washington County, is flowing at the rate of 15,000 barrels a day, far in excess of the greatest well previously known. Oil certificates are selling in the exchanges at 60 cents, which means $9,000 a day to the owners if the oil was all saved; but unfortunately it is not. This well had been doing 9,000 barrels a day, but when an attempt was made this morning to lift out the tools used in drilling, the flow increased to the above figure. No further attempt was made to get the tools, and the oil is running all over the ground, at least one-sixth of the production being lost.

It is said that the tunnel now being constructed by the Baltimore & Ohio Railroad at Baltimore will cost more than $6,000,000. About 1,000 men are employed in its construction.

Rubber Pattern Work.

By J. T. USHER.

FIRST PAPER.

India rubber has been employed by the writer with very satisfactory results as a superior material in the making of small patterns, and a material from which patterns can be made and finished much cheaper than if made with metal, and, in many cases, cheaper than if made with wood.

It is my intention to fully explain the manipulation and working of india rubber for the purpose of making small patterns in quantities (for attachment to cards, sometimes improperly called "match plates") or singly. I shall endeavor to present the subject to the readers of the AMERICAN MACHINIST in such a manner that it can be thoroughly understood and applied with certain success by any intelligent mechanic, whether pattern maker, machinist, or molder.

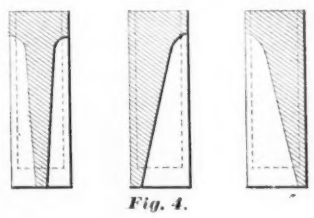


Fig. 4.

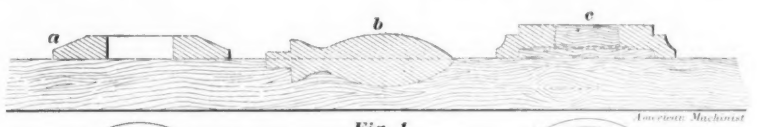


Fig. 1.

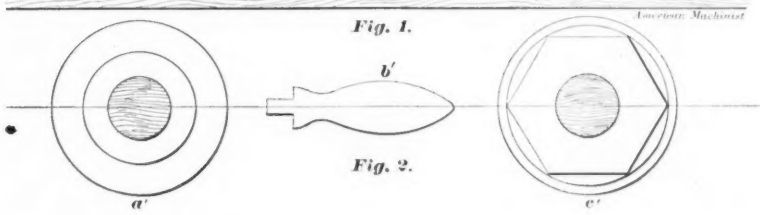


Fig. 2.

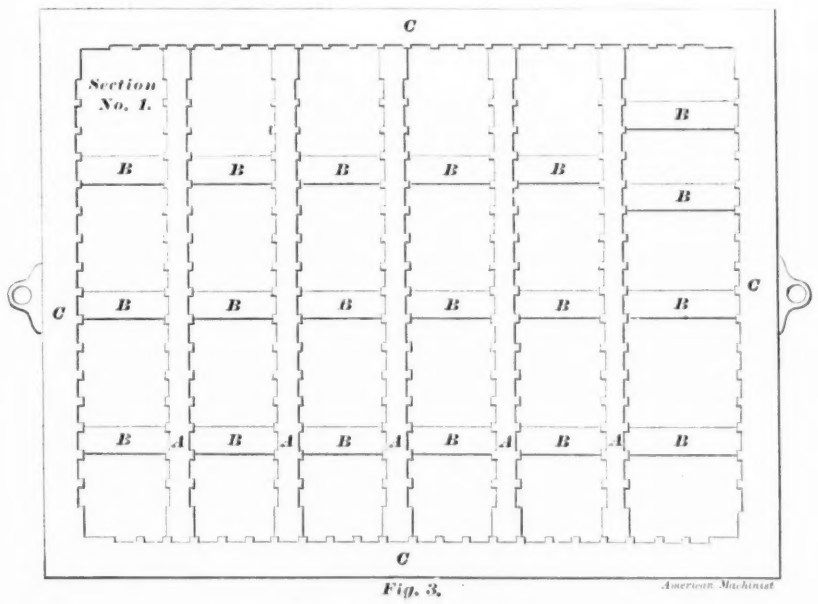


Fig. 3.

RUBBER PATTERN WORK.

In the following articles, I shall use the term rubber exclusively, which will be understood to include all the names under which this material is known, as follows: india rubber, caoutchouc, ebonite and vulcanite. I shall not attempt here to explain what rubber is, as I do not think such explanation would be of any practical value to the readers, as it is assumed that they are familiar with rubber in some of its many forms.

To commence with, I shall devote one or two papers to card patterns, match plates, and the grouping of patterns generally, for which rubber patterns will be found to be specially adapted, first on account of their extreme lightness; second, durability; third, strength; fourth, freedom from shrinkage after they are vulcanized, and also from warpage; and fifth, that rubber patterns are not affected by water, or by acids (except nitric acid) or by heat or cold under ordinary conditions.

For the information of those readers who have had no experience with pattern work, and those who are unfamiliar with card patterns and match plate pattern work, I will explain what they are, and the most approved methods of making and finishing the same; but first, as reference will be frequently made to follower boards, I will explain what they are.

FOLLOWER BOARDS.

A follower board is a board made a little longer and wider than the flask with which it is to be used, whether the flask be a snap flask, bench flask or floor flask.

It may be a perfectly level board on the plane surface; it may have a raised surface, or it may be cut out for the pattern to fit into as far as the division line, according to the form of the pattern.

Figs. 1 and 2 will show at a glance the adaptation of the follower board in each of the above-mentioned cases; *a a'* plane surface, *b b'* board cut out for pattern to fit into as far as the division line, *c c'* raised surface.

It will be seen later on that the follower board is to a certain extent a substitute for both card pattern and match plates, with this difference, that in the case of the former, the patterns are always left in the mold, the gate and sprue channels must be cut out by hand, the patterns lifted out separately, and in the case of the latter, the patterns are lifted out of the sand or mold all together with the card or plate, leaving the mold with gate and sprue channels complete ready for the metal, with the exception of the facing and what fixing has to be done if the mold is broken or defaced in any way.

MATCH PLATES.

A match plate is a plate upon which a group of patterns have been assembled together in one single casting. Patterns of this description are seldom used, except when castings have to be made from them in large quantities. It is not necessary, though, that the patterns so grouped should be all of the same kind; as many different kinds can be grouped together on the same plate as can be conveniently placed in the flask with which the plate is to be used; however, such patterns should be used or molded on the plate from which the same number of castings are always required. In making a match plate, the patterns are to be grouped together as closely as safety and weight will allow.

A match plate can be made in any ordinary flask, providing the guide pins are in good condition, and that care is taken to have the plate fully as large or larger than the outside of the flask (including the lug or portion for the guide pin hole) with which the plate is to be afterwards used.

In my own practice I have had them made in a sectional flask, Figs. 3 and 4, each section or compartment of which constitutes in itself a separate flask.

In using this flask, if the patterns and castings from or on the match plate are all of the same kind, it is not necessary to have more than one preliminary pattern, or where more than one pattern is used on the plate, one preliminary pattern of each kind, in order to make a match plate.

SECTIONAL FLASK.

The sectional flask was designed for making match plates exclusively, and was arranged as follows: The internal measurement is 24″x18″. Around the inner surfaces of the flask are cut a series of ¾″ mortises spaced 1″ apart, the cross-bars (marked *A*) are made 18¼″x1″, and of any depth required, with a tenon ¾″x½″ on each end (which fits any of the mortises in the flask marked *c*); along each side of these cross-bars are also cut a series of mortised grooves, which, when the cross-bars are in place, correspond with those in the flask; these cross-bars and the subdivision bars (marked *b*) can be arranged in spaces, so as to make the sections of any desired size from 1″ square upwards, according to the size and the distance desired between each pattern. Fig. 4 shows sectional views of the different forms of tapering these cross and subdivision bars, so as to adapt them to the requirements of any particular case that may present in every-day practice. The sectional flask can be made large enough to make a match plate the size of the largest flask in the shop with which a match plate is to be used, and then to reduce the area of the flask by means of the cross and subdivision bars when making match plates for smaller flasks, thereby using the one flask for making every size of match plate required.

This method of making and using a sectional flask for making match plates is, so far as I am aware, original with myself, though I presume the idea may have suggested itself to others, and been used by them; but I have always seen match plates made with either a full complement of patterns, or by an improvised arrangement where but one pattern was available. A modified form of this flask could also be used in ordinary practice, when castings are wanted in a hurry, and but one pattern was on hand, instead of having to put them in with other work.

A match plate can be made as follows (using the sectional flask). After arranging the sections of the flask to suit the size and form of the preliminary pattern or patterns, one-half of the flask is placed on the follower board, the preliminary pattern is then placed in section No. 1, or, if there is more than one pattern, in as many sections as there are patterns. Now proceed to make up the mold in one or more sections, as though each section were a separate flask; when this is done, place on the bottom board, and turn this half or "nowel" of the flask over, take off the follower board, leaving the pattern in the mold; put on the other half of the flask (the "cope") after arranging the sections of the same, in the same way as those in the "nowel" or lower half of the flask, and proceed to complete the mold in each section; when this is done separate or take off the "cope," lift out the pattern or patterns, and proceed in the same way to make up each section in succession until the whole or as many as are necessary have been molded, for the size of the match plate required. The gate channels can now be carefully made, connecting each pattern with the next pattern, and also with the main gate channel at one or more points, as desired; the sprue and riser channels are then made, the molds faced up, and the molds are then completed. Now before putting the flask together again for the last time, place three or more distance pieces or strips between the two halves of the flask (nowel and cope); these distance pieces are

to be made of whatever thickness it is desired; the plate should be, generally, from $\frac{5}{16}$" to $\frac{1}{2}$"; place on the cope, and then cover up the open space around the outer edges of the flask with clay, to prevent the metal from flowing through, taking care not to let the clay impinge on the inner edge of the flask, or, in place of the clay, strips of wood can be nailed over the open spaces, if preferred. The mold is now ready for pouring.

Match plates are generally made of composition, brass, or what is termed white metal, on account of the expense of finishing after they are molded, though they are frequently made of cast-iron.

In either case, when the plate is cast, it is placed in pickle in a bath of blue vitriol (sulphuric acid) prepared generally by diluting the acid one to four—one part acid, four parts water. But this formula may be changed to suit the ideas of the person using it. I have occasionally used the pure acid. The time for immersion will depend altogether on the strength of the acid. I think that the addition of a little sal ammoniac reduces the labor somewhat when finishing. When the plate or patterns have remained in the bath long enough to thoroughly cleanse them, they are taken out and washed off with clean water; if the casting is a good one, it will need very little finishing before it can be used as a pattern. I have had the best results in finishing patterns of this description by adopting the somewhat unmechanical method of repeatedly breaking off the points of my files as they became dull, and consider it more economical than grinding scrapers, the points of which soon get dull on such work as this. When the plate and patterns have been sufficiently filed and scraped, they may be shellaced or oiled, but the best way to treat them is to have them electro-plated, which can be done as soon as taken out of the bath, if the casting is a good one, and then finish by burnishing; they can also be galvanized and finished by burnishing, if preferred. Another and very economical method is to take them out of the bath, and, after filing and scraping them, to coat them over with the following preparation:

Take of pure beeswax, turpentine, and blacklead or plumbago, equal parts; melt the wax, add the turpentine, and then stir in the plumbago, and apply one or two coats with a brush on the match plate, warming the latter also.

As the turpentine is very inflammable, great care must be exercised in handling it near a flame, as the vapors of the turpentine will sometimes communicate the fire a considerable distance; it can, however, be kept hot by placing the vessel it is mixed in in boiling water.

Metal patterns of every kind can be coated with this preparation, which will be found to become very hard after the turpentine has all evaporated, and to leave a nice smooth surface on the pattern; consequently it will be seen that, for a very large variety of patterns, the pattern could be used without any finishing whatever, excepting the coating above referred to.

Extensive experiments are being carried out in England to determine the holding power of different kinds of anchors. A good deal of progress has been made of late years in the construction of anchors, and the experiments are to be made for the purpose of finding out which is be[st].

New Industries at Hohokus.

At Hohokus, on the Erie Railroad, just beyond Ridgewood, N. J., a new corporation, known as the Cohaukus Manufacturing Company, began business recently in a new factory. The corporation is organized for the manufacture and sale of cotton, wool, and other fibers. The capital stock is $150,000, divided into 1,500 shares of the par value of $100 each. The principal stockholders are: Henry G. Stearns, of Lincoln, R. I.; William S. Stearns, of Wyoming, Ohio; and William D. Rosencrantz, of Hohokus Several other manufacturing concerns are about to locate here, induced by the heavy fall in the Hohokus River, cheap property, and low freight rates to New York City.

Shop Talks.

BY FRED H. COLVIN.

I overheard a little conversation in the shop not long ago that illustrates two types of men. Jack has come in to borrow Frank's hammer—it is never reversed—Jack always does the borrowing, and as Frank is a new man it hasn't yet got to the point where Jack's cheek will take tools without some apology in the way of asking.

"Got a new hammer, Frank, I see."

"No, same one I've had for five years."

"New handle, then."

"No, wrong again, the same one it always had."

"Well, you must wash your hands every time before you use it."

There is no need to listen longer; we have heard enough to furnish food for thought.

The cause of Jack's astonishment was the fact that Frank's hammer handle was not black with grease, but was kept so as to show the grain of the wood as clearly as when new. There is no need to wash your hands every time, as Jack insinuated, and there is no need to get grease on the handle. You can get a better grip on the handle if it is clean than if it is saturated with grease. It takes but a moment to wipe off most of the grease from your hands, for, of course, you always have a bunch of waste handy, and by just wiping the handle when through using, it is kept in good condition. A coat of shellac once in a while will help keep it in good condition, and will prevent it from roughing up.

This same plan may be extended very profitably to all kinds of tools; they should be kept clean, whether they are steel or wood. I do not believe in this everlasting scouring of tools and machinery generally, but I do believe they should be kept clean and free from dirt and rust; they need not shine like a mirror, but should be in good working order.

Some men will break hammer handles by the dozen, while others on the same work will rarely break a handle. It isn't all in the handles, it is mostly in the men. A little judgment will help things along wonderfully.

Some men seem to forget that a light hammer produces a riveting effect on the head of a wedge or chisel, and you see them using a light hammer on work that should be done with a small sledge. This is a fruitful source of broken handles; the greater part of the handle renewals can be rightfully attributed to this cause.

Aside from the handle breakage there is the inefficient work and the smaller quantity of work performed; these, together with the handles, make the "handle smasher" an unprofitable man.

There is still another feature that may be considered, though of less importance than the other two, namely, the effect upon the heads of the chisels, wedges or keys. The heads of the chisels need frequent grinding to trim the beautifully "scalloped" edges that protrude. When it comes to keys, it is bad enough to strike them with a heavy hand hammer, but where they are struck with a light hammer, and the blows repeated, as is necessary to produce the desired effect, the head of the key resembles a relief map of a mountainous country.

There is such a thing as using a hammer that is too heavy; but, except in riveting, the limit, it seems to me, is only that of convenience and the strength of the operator. It is not convenient to use a large hammer for small work, but I do not think that ordinary work can be injured by its use if the blows are regulated to the work. It is safe to say that time is wasted, handles broken, tools and work bruised and marked, and energy uselessly expended by the use of hammers too light for the work, while the vices of the hammer that is too heavy are few in number, and not of an expensive character.

LETTERS FROM PRACTICAL MEN.

A Correction.

Editor American Machinist:

I notice in my article on Mechanical Flight, published in your issue of Oct. 1, a slip where I stated "by Professor Langley's own figures he expends $2\frac{3}{4}$ times the power to haul a given load," etc. This should read $3\frac{3}{4}$ times, etc. The statement that 533 pounds can be hauled on a railway at 50 miles per hour, with an expenditure of one horse-power, should read 725 pounds, etc.

Of course I do not pretend that the railroad people *are doing* so well. Mr. Gooche's experiments were made upon a hard level and straight track, which is more favorable to economy than tracks as we see them every day, and as well described in Mr. Crawford's letter.

WILLIAM H. HARRISON.

Question 399.

Editor American Machinist:

The purpose of this letter is to remind you of, and to make a few remarks upon your reply to J. H. (399) in your Sept. 3d issue.

Your surmise is probably correct; conceding your diagnosis the proper one, would it not have been better to suggest to him, for instance, a scheme of employing all his spare time in visiting places where problems in mechanical engineering are being daily applied and solved; to note the similarities and dissimilarities of this practice to the theory and practice gained from books and school; suggest the advisability of his securing employment with some mechanical engineer during his vacations? Had such advice fallen to me in my school-days it would have been a great help to me.

The answer of a minister to one desirous of succeeding in mathematics was:

"My dear friend you must chew, swallow, digest and assimilate triangles, squares, cubes and all kinds of polygons, so they may become a part of you."

Our friend "J. H." needs no reprimand for his impatience, but a trusty guide, who will see that he diets on problems of a mechanical nature, in the greatest variety of dishes; he will now and then find a bone, or here and there a piece of tough chewing, and will sometimes feast indiscreetly; these will be restraining influences of a much better kind than any series of reprimands or any warning review of the difficulties to be overcome. J. B. STENIERT.

Ball Bearings.

Editor American Machinist:

I am glad to see that these bearings are being discussed. A few persons here hold them to be unmechanical devices, but the majority (including most or all cycle men) are in their favor.

Mr. Sterling Elliott's remarks are more forcibly appreciated in England. Here the old practice was, and is, to produce a bearing by grinding the shaft into its box with emery powder. Some of the emery becomes impacted in the wearing surfaces, and keeps up a continuous cutting. This is the sort of bearing that even our best telescopes are fitted with. The grinding machine is anything but "universal" in this country.

Even in the theoretically perfect case of domes for observatories (mentioned by Mr. Elliott) there are many defects, known only too well to those who have to turn them. No movable dome can be rigid; but these domes are necessarily very light and pliable. They are subject to several deforming strains, due to settlement of the race or supporting ring, unequal temperature, wind pressure, etc. The result is that after a time the balls congregate in threes and fours, the dome sags for want of support, and so on. The method now adopted is this: The dome rests on wheels which run on the race; the axes of these wheels are independent of each other, of the dome, and of the race; but all the axes are fixed to a ring, so that the wheels are equidistant from each other, and they turn as a whole. This is Grubb's arrangement, and it works perfectly.

As regards the anti-friction curve (miscalled Schiele's curves). This curve was known at least a century before Schiele was born, and was fully investigated in the last century by Maclaurin and Dr. Brook Taylor, the inventor of the calculus. It is extremely difficult, if not impossible to produce. Even when it is practically attained, it absorbs more power than a bearing with collars. This curve has never been used for really heavy pressures; it was used once on the screw shaft of a steam launch, and became red-hot in a few minutes. A geared engine was used, so that the pressure was direct, and did not go through the crank. None but a flat collar bearing would suffice for the thrust of a propeller shaft.

Now that American machines put true flat or cylindrical bearings within our power, all kinds of curved bearings must disappear. They could only serve when nothing better was possible.

To recur to these ball bearings, there is a hole in the saucepan, which I wonder has never been noticed. Let one of the cubs go at it with his simple arithmetic, and demonstrate beyond dispute that ball bearings are a mechanical absurdity. It can be done.

C. PURCELL TAYLOR, D. Sc.
Patent Expert.
26 Marchmont St., London.

He Corrects Us.

Editor American Machinist:

I observed in your issue of the 17th September that Mr. Charles H. Cramp, the Philadelphia shipbuilder, claims that England is ahead of every nation in the world at naval architecture and shipbuilding. I am surprised that Mr. Cramp should make such a mistake. Had he named Great Britain, I could understand him; but Scotland stands as a nation in shipbuilding—England does not include Scotland. What have you to say, Mr. Editor? J.

[We printed the matter as Mr. Cramp put it. There is, undoubtedly, too great a habit in this country of speaking of England when the reference should be to Great Britain. This is quite equivalent to the mistake of our correspondent in referring to Scotland as a nation.—ED.]

Patent Cases.

Editor American Machinist:

No mechanical paper which comes to my desk is perused with more interest than the AMERICAN MACHINIST. I admire the sterling quality of the matter, and the beautful manner of its presentation. This, I think, is sufficient excuse if I now and then take issue with your statements. This time I find some matter for criticism in your article on Patents and Patent Laws, in your issue of October 1.

In this you say the granting of patents is a profitable business for the government. That the Patent Office is the only bureau which pays its expenses is very true, and it is also true that Uncle Sam has no bureau of more importance to him, nor one which gets more shabby treatment. But to say it is a source of profit to him is not correct. The receipts of the Patent Office are in excess of the expenditures, but the surplus is simply laid away. It now amounts to something over $4,000,000, and stands credited to the Patent Fund. The receipts of the Patent Office cannot be used for any purposes except the purposes of the Patent Office, and hence, though it has many times been proposed, not a dollar of that money has ever been appropriated for any purpose except maintenance of the Patent Office. The whole income could, with great advantage, be expended for improved facilities in the Patent Office, but Congress year after year fails to appreciate the necessities of that office.

The law's delays are proverbial, and it is quite possible in patent causes they are worse than elsewhere. Much of this, however, is to serve the personal convenience of lawyers who have too many irons in the fire. But the grand imposition upon patentees, which consumes their substance and their time, and makes the patent law a byword in the mouths of men, is the assump-

tion by the courts of power to revise the judgment of the Commissioner of Patents as to questions of novelty and patentability. The Patent Office was instituted for the purpose of determining these questions, and is equipped with all the machinery attainable. This machinery is operated by skilled men whose training is all directed to this particular end. Notwithstanding this, every United States Judge, though he may not know "a hawk from a hernshaw," does not hesitate to say the Commissioner's decision was all wrong, and the patent ought not to have been granted. Nine-tenths the expense in patent litigation is in efforts for and against this result. Of course, the courts must have the power to protect the public in rights existent *before* the invention in the patent, but the evidence for that can scarcely be looked for in the records of the Patent Office, considered fully there, and judged to be irrelevant before the patent was granted. The first and greatest step toward relief to the contesting patentee will be the enactment which makes *res adjudicatur* the decision of the Patent Office on questions of novelty and patentability, except upon such showing as would secure a new trial.

The record of the Patent Office is not so voluminous nor so obscure as you seem to suppose. It grows larger year by year, it is true, but it is perfectly systematized and accessible. Inventions are constantly branching off into new fields, and it is not necessary to thresh all the old straw over and over again. At the same time the skill of solicitors is greater than formerly. Applications are better prepared and patents are clearer and sharper cut, and the labor of the examiner is not much, if any, greater than formerly, while the product is greatly better.

Except patent causes, no cause involving less than $1,000 could go to the Supreme Court. That court was so burdened by an enlarged jurisdiction shortly after the war that it has gradually fallen in arrears, until now four years are consumed waiting for the docket to come around.

That condition will not maintain any longer, because the recently organized courts will hear appeals from the district courts in patent causes, and no such case will go to the Supreme Court hereafter, unless under exceptional conditions. This will greatly facilitate final decisions, and will reduce expenses.

R. D. O. Smith.

Mishawaka, Ind.

The closing of the Ulster County (N. Y.) Savings Institution is in line with similar occurrences that happen quite too often for the credit of this country. It wouldn't matter so much if a half million dollars, more or less, was taken from men who were well able to stand the loss. This would be bad enough, but it bears no comparison to the crime of robbing old people—men and women—who have worked all their lives to accumulate a few dollars with which to get along peaceably to the impending end. The dispatch which announced the failure of the bank says:

It is impossible to tell or even conjecture the effect that the closing of the bank will have on the people of Ulster County. The majority of the depositors are poor people, many of them old men and women dependent on the interest on the few thousands of dollars they had in the bank, and such men and women with tears in their eyes can be seen everywhere about the city, they fearing the loss of their savings.

There is scarcely a conceivable punishment adequate for the crime of systematically robbing a savings bank in which poor people have their little all deposited. That this can be done brings up again the question that we have previously raised, viz., of what use is the pretension of examinations by the State, when such occurrences as this in Ulster County are possible?

Theo. Audel & Co., 91 Liberty street, New York, have just issued a catalogue of books relating to Electricity, Steam and Mechanical Engineering, Arts, Trades and Manufactures, which they publish and sell.

A Few Ideas About Teaching Trades.

By A Mechanic.

After reading considerable on this subject in the American Machinist, I have been thinking that there is still room for a few more ideas. I want to commence by "kicking." I know that people generally do not like to hear much "kicking" about things that they believe are now correct, but hope, if I succeed in showing that I have something to kick at, that I may be excused. For an illustration: Suppose a mechanic has to produce a machine for making a large quantity of small screws at a small price each. He thinks over the matter carefully, and decides that it should be an automatic machine. He goes along further and plans the general principles of the machine first. He then plans the details of the machine, begins to plan and correctly proportion the different parts. He makes general drawings, which are supposed to explain the general principles of the machine, and detail drawings which clearly show the size and shape of each piece. Now maybe his work is at an end, and other mechanics take these plans and go ahead and bring the machine into existence. Now, what will be the first thing a good mechanic will do?

Will he pay no attention to the general drawings? Not interest himself at all in the idea of the machine? Care nothing at all about how it is intended to work, but just take the detail drawings and commence to make the parts as shown, and to the sizes given?

Will he make all the parts in this way, and then, if he is told to put the machine together, consult the general drawings to find out how it goes together?

I think not; that is, if he is a good mechanic he will do nothing of the kind, but instead, he will first study the general drawings. He will find out the general principles of the machine first, then commence to study the details. He will plainly see what each part has to do in the finished machine, and so the reason why it should be made as shown. He will notice the parts that fit closely to other parts, and he will notice the parts that only fit a hole in the atmosphere. He will notice in one place a piece that needs to be almost exactly 6″ long, and there is in another place a piece that only needs to be somewhere near 6″ long, and understand the reason why the difference.

When he commences to make the parts, he knows what he is making. He knows he is making a machine for making screws, not shaping a piece of stock just as near as he can to a sketch upon a piece of paper given him. Take the case of a scholar in a common school; he is told that a noun is a name. I consider this as bad as the poor mechanic when he starts to build a machine.

He commences at the wrong end of the problem. He commences with the detail, when he should commence with the general plan. He should be taught what a noun, being a name, has to do with being able to read and write correctly, and also be shown some practical examples of why he should be able to read and write correctly, in order to be happy and prosperous in the future.

I do not think that my experience differs very much from the experience of others, so I give an instance from my own experience as a common evidence. I attended a country school until I was fifteen years of age, and believe I got along about as well as the average in that school, but there were many things that I looked upon as blank nonsense. I had sense enough to know that I went to school to learn things that were to be of benefit to me later in life, and there were many things that they tried to teach me that I could see about as much connection with practical use as a knowledge that a telegraph pole should be 30 feet high would be to a man who desires to learn watch making. At the age of fifteen I had to shift for myself for a while, after which I got a chance to attend one more term of school.

While "knocking" about, I learned from some practical examples some general ideas that I believe *could* and *should* have been taught me at school. The result was that when I got a chance to go to school again, I learned more in this one term (of eight weeks) than in any previous two years.

Now all the teaching that I am acquainted with (with one exception) is conducted upon this *faith* plan. You are expected to have faith that you will only be taught such things as you need, and then blindly grope your way along till you get to a place at last where you commence to get a little light. Now would it not be better, if possible, to have a little light at the start? It would be more interesting, more pleasant.

When a person is interested in his work, that work is not so tiresome; in fact, this interest can go so far that the hardest work becomes a pleasure.

There is no way of creating an interest in work half so good as to have a grand object in view, and to know at the start just what the benefit will be if you succeed; then when great obstacles are thrown in your way you feel bound to overcome them.

I believe that any teaching that depends too much upon the *faith* of the students (in this enlightened day) will not succeed well, for most people do not have a large amount of faith. In this respect I believe most people are somewhat like me. I can be told by a man who flourishes a diploma as long as a line of railroad, that it is 100,000,000 miles to the moon or half a mile. I take as much stock in the accuracy of one statement as the other until he shows me his proof, and this proof is not his diploma, but a good, reasonable way by which he found this out.

I speak of one exception, and I believe if the school for teaching the machinist trade proposed by Mr. Sweet could be modeled after this exception, that it would be a great success.

This exception is the jobbing shop where I served an apprenticeship at the machinist trade.

I have noticed that it is the opinion of some who have written on this subject, that the fault with the old way of teaching trades is that the boys are not shown enough, but are left to shift for themselves too much; that there should be plenty of men to follow them around and keep showing them, in order that they should learn fast.

Now I must advance an idea just the reverse of this.

I believe this way of letting the boy do his own thinking, as much as possible, is just the best way in the world for a boy who has got the *something to think with*, and that it is of no use to try to make a good mechanic of any other kind. This jobbing shop furnished just what the common school failed to furnish; that is, practical examples of work to be done, and so with it the necessity of good ways of doing it. The foreman in this shop was a very busy man. He seldom, in giving a man or boy a piece of work to do, gave any instructions about how to do the work.

He would always be very particular that the workman knew just what it was wanted to accomplish, and was willing that he should do his own thinking, which he was hired to do as well as the foreman was. Suppose in this shop I got a job to put a new steam chest on an old engine cylinder. The foreman would show me the old cylinder and the new casting. He might tell me to be careful to get the gland bored about the same height from bottom as the old one, if he had reason to think that I did not know this already, or some other such point as this, but about how to proceed to do it, and what tools I should use, were questions I had to attend to myself. Now this sets me to thinking.

The holes are all drilled and tapped in the cylinder, and I have to lay out the holes on the steam chest to correspond. I think if I only had to drill the cylinder to fit an old steam chest, that it would be quite simple, for I could scratch right through. I keep thinking, and I think hard, too, for I do not want to give up that I am "stuck." Perhaps I can't think of any very good way to go about it, and so in that case I hunt up the foreman or some journeyman, and ask questions.

Then I understand well why he should proceed just as he does, for I have seen in my own imagination the difficulties that his methods are got up to overcome.

I have learned something that I will not forget, for I have been interested in the whys and wherefores of this thing myself. Perhaps I do not get stuck, and perhaps I succeed in finding some method better than had been used before for the purpose, as I have many times.

I do not mean to say that if this foreman should see any workman doing anything very bad, that he would not try to correct him, but I do say that they were particular to get a good class of men and boys, and that it was not often that there was anything very bad going on.

I claim that this is the best way I know of to teach the machinist trade. To just be able to run a planer, lathe, or milling machine, on work that seems to be almost designed to fit the machine, is a very small part of the trade. The great part of the trade is to be able to do your own thinking; to be able to plan your work well, and take the advantage of things; to acquire a judgment of the strength of things, so as to properly fasten your work; to be able to measure correctly in difficult places; to be able to bring your work out right. In fact, a good machinist must be a good mechanic. By the way I have heard some men talk, an uninitiated person might get the idea that the only thing a machinist needs to know is how to force a machine in the way of *feed* and *speed*.

This kind of talk does not tell anything about the machinist trade, but instead, tells what the speaker does not know about it. It seems to me that some people use the word—machinist—with a different meaning from what it should convey. A man who can make good boots and shoes is a good shoemaker, but we often hear the word—shoemaker—applied to a man who only trims the heels of shoes in a factory; now both of these men can't be shoemakers, unless the word is a very elastic one. To build a good machine in what Chordal calls a "Simon pure" machine shop requires some good machinists, but to build the same machine in a factory, fitted up on purpose to build this machine in great numbers, by the most modern methods, might not need any machinists at all, on the regular product.

Good machinists would be needed as tool makers, and men for repair work, as some machinists are needed in every factory where there is much machinery, but a factory to build such a machine need not be any more a machine shop than a sugar-mill is.

There is a large amount of fraud practiced every year among managers of these machine factories in hiring boys, to whom they represent that they will be taught the machinist trade, when really it is only a scheme to get their help cheap. I do not believe it would pay a boy to go to any school or work in any shop just to learn to be a machine operative. Manufacturers would rather hire green men who they can break in on their own work in a short time, and so have the advantage of having them know just what applies to *their* work. So if a school is started to teach the machinist trade it should do it to the letter, for anything else is not needed.

Cautiously opening the door of our sanctum, he tossed in a paper upon which was written the following effusion, and succeeded in getting the door closed again just in time to escape our trusty club, whose vigorous bang upon the door accelerated his retreating footsteps:

"How dear to my heart is the shop of my boyhood, and the old log lathe I used to revile, where I turned steamboat shafts with a hook tool, and planed up the slides with a file; and the queer tools I used, and the limited pay, and the drunk threads I made would astonish the boys of to-day; and the sore head I got when that hook tool caught and yanked me over the lathe, that old-fashioned log lathe, the iron-clad log lathe, the grease-covered log lathe that stood by the wall."

C.

AMERICAN MACHINIST

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A Misapprehension Concerning Patents.

We have received from a correspondent, who is a mechanic and inventor, an extended account of his personal experience in a controversy with a man who had a patent on a metallic fastening for fruit baskets. It is related that, after large numbers of these fastenings had been made and sold, some other man in New York investigated the matter and found that the patent was invalid because the same thing had been patented years before—so long before that the earlier patent had expired. The investigator thereupon commenced the manufacture and sale of the fastenings, and upon being sued for infringement successfully defended the suit, establishing the fact that the patent was invalid, and securing a decree to that effect. Upon this, our friend, relying upon his perfect right so to do, invented and built a machine for the purpose, and proceeded to produce the fastenings for the market. Thereupon suit was brought against him by the holder of the patent, and as the case was brought in the U. S. court (where alone it could be brought) our friend complains that he could put in no defense or answer whatever, except through a lawyer admitted to practice in that court, and who would charge a high price for his services. Being unable to pay this charge, our friend concluded that he was thereby prevented from making any defense, notwithstanding the fact that the patent under which the action against him was brought had already been declared to be invalid, and this in the same court where he was sued.

Similarly, our friend complains that he could take no action, either defensive or offensive, without first employing a lawyer who "belonged to the union," so to speak, and who charged accordingly for his services. He found he could not take measures to prevent the fastening being marked "patented," except by bringing action in the same way and by the same expensive process, and hence concluded that any one could mark "patented" on anything he wished to monopolize, even if no patent had been granted thereon; or could even bring suit for infringement without having any patent, so long as no one interested was able or felt inclined to pay the necessary lawyer's fees.

We fear that our friend has reached his conclusions somewhat hastily. In a suit for infringement of a patent the patent must be specified, of course, and must be produced in court to be examined. It is next to impossible for such a suit as our correspondent complains of to be brought, for the very reason that, if brought, the offensive action must be commenced by a lawyer who has been admitted to practice before the U. S courts, and who must sign the bill of complaint, in testimony that he believes the suit to be well founded and proper to be brought. Such an action based upon a patent previously declared invalid would almost certainly result in trouble for the lawyer.

The law fixes a penalty for marking "patented," or words of like import, upon unpatented articles, for the purpose of deceiving the public. As the penalty is one hundred dollars for each offense, and as one-half of this goes to the United States, the district attorney may generally be relied upon to furnish advice and direction free of charge; but of course the person who is to be benefited to the extent of the other half would be expected to furnish all the necessary proofs.

In the particular case cited, however, the device had been patented, and the fact that the patent had been declared invalid did not change this circumstance. There is, then, in such case, really no false marking which can be reached by the statute, and in this respect the statute could no doubt be improved, and we commend the subject to our law-making powers as one worthy of their consideration.

In the event that a patent has been finally declared invalid in the proper court, it should not be possible for any action of any kind to be based upon such invalid patent. No such action could prevail, of course; but when brought it must be defended. On the general principle that the defendant is entitled to be heard, he may, if he so desires, plead his own cause. We have never yet recommended that lawyers act as their own mechanics, and we hesitate to suggest that any person unfamiliar with the practice of law would do a wise thing in securing himself for his first client; but in the supposed case, which is so very plain and simple, our friend might try it, and could, no doubt, upon proper representation, obtain permission from the court to represent himself, as his letter to us demonstrates he is abundantly able to do. In complicated cases it is manifestly necessary that all pleadings made before law courts should be drawn by men who have proven their ability to do the work properly.

We know of no lawyer's union by which their charges are regulated. It looks to us from outside the fraternity as if such a union would not hold except by periodical destruction of a considerable percentage of the members. Our friend would not need a very high-priced lawyer; his simple suit might have been given into the care of a novice who would perhaps gladly have taken it for the glory in it, and what he could collect from the opposite side in the way of costs. But we presume that in the law, as well as in the field of mechanics, if we trust our affairs to inexperienced persons we take the risk of damage and failure upon ourselves, and must settle for all expenses on account thereof.

A Newspaper Transfer.

It is probably known to most readers of the AMERICAN MACHINIST that its publishers have for more than three years past also been publishers of *The Locomotive Engineer*, a monthly paper devoted to the special interests of locomotive engineers and firemen, though edited and published in a way making it a wholly distinct, original and independent publication.

During these three years *The Locomotive Engineer* has gained a large circulation among the class of railroad men for whose special benefit it was intended, very many of them having found in its pages their first inducement to become habitual readers of any paper specially devoted to their line of work.

On behalf of the AMERICAN MACHINIST PUBLISHING COMPANY we desire to announce that, owing to the demands upon the time of the executive officers of that company, required to meet the steady growth of their other business, as publishers of the AMERICAN MACHINIST, the company has, under date October 5, 1891, disposed of *The Locomotive Engineer*, including all right, title and ownership in same, to Angus Sinclair, formerly editor of the *National Car Builder*, and John A. Hill, the latter having been editor of *The Locomotive Engineer* from the beginning. The publishers also announce that all contracts, of whatever nature, heretofore made with them, as publishers of *The Locomotive Engineer*, will be fulfilled by the new proprietors. No one who knows either Mr. Sinclair or Mr. Hill can doubt their willingness or their ability, not only to fully carry out their agreement, but to make a good paper, which will be helpful to a very large class of working railroad men in every grade of the service. They have our hearty good wishes for their success. Hereafter the office of *The Locomotive Engineer* will be located at 912 Temple Court, New York City, where all correspondence relating to it should be addressed.

The whaleback steamer, a type of which was shown in the AMERICAN MACHINIST of Sept. 10, has been severely criticised by the English press. It was "a barge," and, in fact, anything but a rather sensibly designed freight steamer. Now, however, the North German Lloyds are considering the practicability of building several vessels of this derided Yankee type, which will undoubtedly stir up our British friends to a display of increased sarcasm.

Literary Notes.

BEVEL GEARS. Plain Practical Directions for Drawing, Sizing and Cutting Bevel Gears, showing how the Teeth may be cut in a Plain Milling Machine or Gear Cutter so as to give them the Correct Shape from End to End, and showing how to get out all Particulars for the Workshop without making any Drawings. By John W. Newall.

This is a book in which the author describes and illustrates his system of cutting bevel gears by rotary cutters in such a way that they are declared to be so nearly correct that the error is brought well within the practical limits incident to mechanical operations of this kind. This is accomplished by means of two cutters, each taking two cuts through the spaces of the gear, or four cuts in all. It is explained, however, that this is not so slow, as compared with the usual method of two cuts, as might at first sight appear to be the case, for the reason that, after the first cut is taken, the remainder are so light that a very rapid feed can be employed, and the work is quickly done. The first two cuts are made by a cutter which is flat on each side, and this cutter is placed at one side of the first tooth in such a way that one side of the tooth is cut radially from top to bottom. After this the other sides of all the teeth are cut radially by the same cutter, the cutting angle in these two cuts being that which would be used with any cutter used in the ordinary manner. A cutter is then used which is curved at the sides to suit the curve of the face of the tooth at the middle of its length. This cutter is then used for the faces of the teeth only, the flanks being left radial, as cut by the first cutter. The cutting angle for the second cutter differs from that for the first cuts, and it is by this change of the angle, mainly, that the accuracy of the tooth is secured. Diagrams are given which show graphically the error by this system on a tooth of 4″ circular pitch, amounting in this case to .007″, from which it is seen that the error for most cases occurring in practice would be inconsiderable. The book is written with special reference to the needs of practical men who have gears to design or make in the shop, and is well worthy of study by all who are interested in the subject of gears. In its subject matter, illustrations, paper, binding and style of printing the book is a model of what a book intended for use in the shop should be. The process described is, however, patented, at least in Great Britain; we are not informed as to whether or not it is patented here. The book is published by John W. Newall & Co, engineers, 5 Cross street, Manchester, England.

POOR'S HAND-BOOK OF INVESTMENT SECURITIES. For the use of Bankers, Investors, Trust Institutions, Railroad Officials; supplementing Poor's Manual of Railroads. Second annual number.

The object of this book is best stated by the following extracts from its preface. It is a hand-book of securities issued by the several railroad corporations of the United States, by the several States, and by the municipal bodies and incorporated industrial enterprises throughout the country. Its purpose is to supply, at a glance, information upon which one in affairs is constantly called upon to act, but who has no time for the examination of the sources, even if, as is not often the case, they were at hand. It is intended to be to those seeking to invest in securities of any kind, what a city directory is to the general public. There are now in the United States about 2,500 railroad companies, each having an organization and financial system of its own. The nominal value of the securities issued by them, of which there is an endless variety, exceeds $10,000,000. For full statements of their financial condition and operations, the Manual of Railroads is still to be referred to; but where dates, or isolated facts, such as the times and places at which dividends on the share capital, or interest on the bonds of railroad companies are payable, with the amounts of rates of each; or at which the annual meetings of the several companies are to be held; or the places for the registration of their share capital, with the names of registrars, with other information of the

kind, is wanted, a book less voluminous than the Manual, and in which the information of the kind described is arranged under appropriate headings, and alphabetically, is the proper supplement to such a work.

In addition to the kind of information as above set forth are statements of the dividends paid on the share capital and interest on the bonds of railroad companies, and of the market value of such share capital and bonds through a series of years; of the railroad bonds maturing for ten years beginning with 1891; a schedule of securities listed on the New York Stock Exchange from 1879 to 1890 inclusive, and the earnings of the railroads for periods of many consecutive years.

Next in importance to the securities issued by our railroad companies are those issued by the United States, and by the several State governments, and by municipal (and industrial) corporations throughout the country, and which now amount to many thousands of millions of dollars. Information in reference to such, excepting, perhaps, those of the United States, is not readily accessible to the great mass of investors.

This Hand-book covers the entire field of investments in the United States—financial condition, indebtedness, sources of income, assets and population of every State, county, city and town issuing its obligations for any purpose. It contains full statements of the industrial enterprises in which the public, by virtue of holding evidences of debt issued by them, secure an interest.

The importance and originality of these new features, coupled with their comprehensiveness, makes this edition a very valuable one.

Its price is $2.50. It can be procured of H. V. and H. W. Poor, 70 Wall street, New York.

PROCEEDINGS OF THE ENGINEERS CLUB OF PHILADELPHIA. Vol. VIII, No. 3, July, 1891.

This number opens with the brief inaugural address of Wilfred Lewis, Esq., the president of the club, whose portrait (a most excellent likeness) forms the frontispiece. Then follow papers on the use of a pumping dredge, on crown bar stays and locomotive springs, on street cleaning in Washington, D. C., on the relative efficiencies of steam nozzles of different forms, on the coal fields of Alabama, and on a scheme for a land-locked water route from Long Island Sound to the Mississippi River. Wilfred Lewis describes a new feed-ratchet device invented by him and applied by Messrs. William Sellers & Co. to their planing machines, and there are various minor items, minutes of meetings, etc.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(442) T. D. K., Gowanda, N. Y., writes: Please inform me what you consider to be the best flux to use in melting brass, and like compositions. *A.*—Hard wood charcoal.

(443) G. W., Winsted, Conn., asks: How can a tenant who gets his power from a water-wheel determine how many horse-power he is using? *A.*—Apply, or get some one to apply, a dynamometer.

(444) B. W., Newark, Ohio, writes: Please inform me through your journal if the Marshall valve gear, described in your paper of July 18, 1889, is patented; if so, please give date of patent. *A.*—This valve gear is patented, but we do not know the date of the patent.

(445) T. C., Decorah, Iowa, asks: Does the top of a wagon wheel move any faster than the bottom when running over a surface? if so, give reason. *A.*—All points in the circumference of the wheel will move around the center with the same velocity. If the velocity is referred to a point on the ground, then the upper points of the wheel will move faster than the lower ones. It seems to us that questions of this kind are of very little or no practical value.

(446) F. J. P., Leonardville, Kan., writes: I have been referred to you for obtaining the name of an institute in which steam engineering is taught; also state to whom I should apply for an engineer's license. *A.*—We assume that you wish to acquire the knowledge and experience of running an engine. We do not know of any institute where engine running is taught. The best way, and, we believe, the only one, is to accept a position as fireman, and work your way up by faithful service and constant study. A license is not required in all cities; in those where one is required it is generally granted by the police department, or at the office of the inspection of steam boilers.

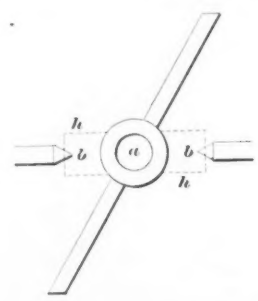
(447) R. P., Philadelphia, Pa., writes: Please inform me of the best way to case-harden soft steel pieces which weigh from one to eight pounds each. I wish to harden the above in quantities of 50 to 100 pounds. *A.*—They are case-hardened in the same way as is adopted for wrought-iron. They should be placed in an iron box full of bone dust or some other animal matter containing a considerable amount of carbon; care should be taken to imbed the articles without touching each other. The whole is subjected to a red heat for a period varying from one-half of an hour to eight hours, according to the depth of case-hardening required. They are then taken out and quenched in cold water. See articles on "Practical Details of Case-hardening," by B. F. Spalding, in our issues of May 22 and June 5, 1890.

(448) R. A. P., Saginaw, Mich., writes: Kindly inform me through your paper how much heating surface will be required to heat 30 pounds of water per hour from 50 degrees Fahr. to 200 degrees, with exhaust steam at 212 degrees; the iron is one-eighth of an inch thick; also what saving in area would result from using copper of the same thickness? *A.*—In the absence of rational methods for investigating problems of this kind, much depends on experiments and experience; we should allow four square feet of heating surface, but this is somewhat more than is usually allowed; in fact, some manufacturers would allow only half that amount. We should also allow the same amount of heating surface when copper is used, because this metal will soon become coated with impurities, and it will then not be a better conductor.

(449) H. J. J., Pittsburgh, Pa., writes: Being a regular reader of your valuable paper, and noticing the good advice you generally give to correspondents, I would like to ask you for advice. I have an invention—a steam engine without an exhaust—which I would like to test thoroughly, but it will take more money than I can spare. What would you advise me to do? *A.*—Your idea is not new; some three or four years ago a steam engine was built on this principle, and considerable money expended in the attempt to make it a success. At the time we saw it some changes were being made upon it, and we did not see it run, although we were assured that it had run. Our opinion at the time was that it never could be made to run successfully, and this opinion seems to be confirmed by the fact that we never heard any more of it. We believe that the principle is a fallacy, and our advice to you is, do not waste your time upon it, and save your money for better purposes.

(450) Subscriber, ——, Minn, asks: What will be the difference in efficiency in substituting flues of a thickness of $\frac{15}{100}$ of an inch for those of standard gauge, namely, .072 of an inch? How do they compare as to the transmission of heat? *A.*—With the thin tubes, steam can be got up quicker, but otherwise there will be practically no difference in efficiency. 2. Give in as few words as possible a simple and accurate way of quartering the cranks for a double engine. *A.*—The simplest and most accurate way is to use a quartering machine. If such a machine is not at hand, the position of the cranks can be determined by means of a spirit level and plummet line. 3. If the valves are properly set for each engine, will not the exhaust go lame or be irregular if the cranks are not accurately quartered? *A.*—Yes; but even when the cranks are correctly set it will be a difficult matter to obtain a regular exhaust with the ordinary D valve, provided no links for reversing are used. If the links are used, a regular exhaust can be obtained by moving the saddle pin out of the center of the link, and suspending it correctly.

(451) W. L., Baltimore, Md., asks: Is there a book from which I can learn how to use the different shapes of material to advantage in designing machinery; for instance, to find the proper proportions of brackets, and the correct shape of ribs, etc.? I am a graduate, but I lack the knowledge aforesaid. I am at present employed as a draftsman, and cannot afford to enter a day school. *A.*—Elements of Machine Design, by W. C. Unwin, will be of service to you. 2. We have a trimmer in the pattern shop, and on its platen are marked different angles of 45, 60 and 67½ degrees. It puzzles us to know what the 67½ is for. *A.*—The angle of 67½ degrees is used for cutting pieces to form an octagon. 3. Please tell me how the machine work on a butterfly valve is done; that is, how is the hole bored, and



the face turned perfectly true with each other? *A.*—When only one valve is to be made, we should cast hubs *h h* to it, as indicated by the dotted lines, so that the valve can be turned on the centers *b b*; of course, care must be taken to have these centers exactly in line with the center *a* of the hole, which should be bored before turning the valve. The hubs can be cut off when the work is finished. If a great many of these valves are to be made at one time, we should make special tools for the purpose.

(452) Q. E. D., Philadelphia, Pa., asks: What effect on the boiler has the oil carried from the cylinder with the condensed steam into the boiler? Is there any difference in the effect if the water be returned hot, say about 200 degrees, or warm? Would not the oil cause foaming? If so, why does it not in boilers supplying steam to condensing engines? I have heard so many diverse statements made by engineers on this subject that I am perplexed. Of course I have an opinion of my own on the subject, but I am young and inexperienced. *A.*—Oil or grease in the boiler often does cause foaming; but the worst effect occurs when it is carried to the boiler with the feed water supplied from an open tank, or a similar exhaust heater, in which the water is muddy or hard. In cases of this kind the more solid portions of the impurities in the water, and the floury deposits—such as carbonates of lime and magnesium—that are precipitated when the water is boiled, appear to combine mechanically with the organic matters in the oils, and when this compound sinks on the plates overnight, or when the boiler is at rest, it clings to the sheets as a loose, spongy mass, too inert to be carried off by circulation or ebullition. The result is that the circulation and ebullition will be retarded, and the resistance to the transmission of heat increased, thereby overheating the plates, which may lead to disastrous consequences; and these are not affected by the original temperature of the feed water. In surface condensing engines the condensed steam—which is pure water—is kept separate from the cooling water, and is used as feed water; the impurities deposited in the boiler by the water when first used are blown off; the consequence of all this is that the boiler is fed with practically pure water. But when pure water is used, the judicious use of oil in the cylinder will have little or no evil effects on the boiler.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

George B. Grant—Gear Wheels. See p. 20.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Ice and Refrigerating Machines, 170 sold, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

"How to Keep Boilers Clean." A 96-page book mailed free by Jas. E. Hotchkiss, 112 Liberty St., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N. Y.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

Universal Grinding Machine. Pedrick & Ayer, Philadelphia, Pa.

Milling Machines. Pedrick & Ayer, Philadelphia, Pa.

Our Automatic Gear Cutting Machine will increase production 50%. The Superior Mach. Wks., Clev'd, O.

Boston Gear Works, Boston, Mass. Gear cutting of every description; noiseless gears a specialty.

$13.00 I. Dea L. Drawing Stands. The original. Send for postal. W. S. Rogers, Troy, N. Y.

One Star Hack Saw will cut steel a whole day without filing.

S. A. Smith, 23 South Canal Street, Chicago, Ill., agent for Holbrook's Raw Hide Blanks for Gears.

The price of the Brown & Sharpe No. 3 Universal Cutter and Reamer Grinder is $200; former price, $260.

Save small iron from foundry refuse. It pays. Use the Woodruff Pat. Separating Machine, Audubon Machine Works, New Haven, Conn.

For the latest improved Eccentric Hook, Connecting Rods and Stub Ends, address T. C. Dill Machine Company, Philadelphia, Pa.

"Twenty Years With the Indicator," by Thomas Pray, Jr. 10,100 sold. Price, $2.50. Order of bookseller; take no other.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

For best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th St., N. Y. Send for des'n.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

Self-adjusting Hand-Screw for Pattern and Cabinet Makers, Wood Workers, etc. Sample by mail for 50 cents. Wm. H. Denney, Lancaster, Pa.

Valuable Books for Machinists and Engineers Send for complete Catalogue to Norman W. Henley & Co., 150 Nassau Street, New York.

The Corliss Engine, by John T. Henthorn: A Manual especially adapted for every-day use. $1, free by mail. Egbert P. Watson & Son, 150 Nassau street, New York.

25″ / 32″ / 37″ / 42″ "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, Newark, N. J.

Complete treatise on Screws and Screw-making, with clear and concise explanation of the methods; 95 illustrations. Price, $1.25 postpaid. E. & F. N. Spon, 12 Cortlandt Street, New York.

Do you wish to become an expert engineer? Hawkins' Hand Book of Calculations will greatly aid you. 10 parts, 25 cents each, or in 1 volume, $2.50. Catalogue. Theo. Audel & Co., Publishers, 91 Liberty St., New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Progressive Examinations of Locomotive Engineers and Firemen," by John A. Hill, editor of *The Locomotive Engineer*, is a new pocket edition of a practical work for locomotive enginemen, by a man with ten years of foot-board experience. Nearly 600 questions and answers, colored plates showing position and color of all signals carried. Price, 50 cents. John A. Hill, Box 1736, New York.

Club Rates.—If no one is getting up a club for the AMERICAN MACHINIST in your town or establishment, send for Circular of New Club Rates, and try it yourself. Address AMERICAN MACHINIST, 96 Fulton St., New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2. postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

MANUFACTURES.

A casting shop is being erected at Brewsters, N. Y.

A fertilizer factory is to be established at Lake City, Fla.

G. W. Goddard is the promoter of a rolling-mill at Berkley, Va.

We understand that a sugar-mill will be erected at Plaquemine, Fla.

There has been an enlargement of the Montgomery (Ala.) Iron Works.

The Upson Nut Company, of Unionville, Conn., is to build a new boiler house.

The Wheeling & Lake Erie Railway Company is to erect shops at Ironville, N. Y.

The National Foundry and Machine Company have been organized, at Louisville, Ky.

New machinery is reported as to be put in the Rose Plumbers' Supply Works, Shendun, Va.

Wyman, Flint & Son are to add new machinery to their paper-mill plant, at Bellows Falls, Vt.

A power house is being erected by the Electric Street Railway Company, at Cedar Rapids, Ia.

A stock company will probably be organized to erect an electric light plant at Bardstown, Ky.

The Bostwick Steel Lath Company, of Niles, O., has been incorporated, with $100,000 capital.

The Jones & Lamson Machine Co., Springfield, Vt., have increased the capacity of their works.

The Curtis Manufacturing Company, of Syracuse, N. Y., will erect a four-story brick factory, 40x18 feet.

G. H. Holgate, of Americus, Ga., S. T. Neil and others will, it is stated, erect an ice factory in Fort Valley, Ga.

A. B. Patterson and others, of Chicago, Ill., are to build new frictionless metal works, at Chattanooga, Tenn.

The Harmon Machine Co., Watertown, N. Y., is building additional shops, in order that it may add more machinery.

The Louisiana Ice and Cold Storage Co., Baton Rouge, La., will, it is reported, double the capacity of its ice factory.

Stock is being solicited for the establishment of a pipe works at Charlotte, N. Y., with a proposed capital of $250,000.

A one-story brick pump and boiler house will be erected at Philadelphia, Pa., by the Pennsylvania Railroad Company.

The Baker Iron Company, Jasper, Tenn., will need full outfit of machinery for the manufacture of bar-iron and steel.

The Smedley Manufacturing Company is erecting a machine shop and foundry 40'x100' and 50'x60' respectively, at Dubuque, Ia.

E. & H. Barnard, of Rome, N. Y., are to erect an $8,000 brick factory. It will be 35'x70', and three stories high with basement.

A new town is to be built at Marlinton, W. Va., and the West Virginia & Pittsburgh road will erect machine shops at that point.

It is stated that the Brosius Sewing Machine Company, of Atlanta, Ga., will double the capacity of its sewing machine factory.

Brown & Benton, a new firm manufacturing brass goods and household novelties, have established a factory at Meriden, Conn.

Work is progressing on the new shop of the Ulrich Engine Co., Florence, Mass., and it will be ready for occupancy by December.

The organization of a stock company for the purpose of establishing an iron foundry and machine shop is proposed at Bartow, Florida.

The Crown Wax Wheel Machine Co. has been incorporated at Kittery, Me., to manufacture shoe machinery, with a capital of $200,000.

W. T. Adams, E. C. Gordon, W. M. Ross and others have incorporated the Suwanee (Ala.) Phosphate Co., with a capital stock of $110,000.

Sutherland & Blackman, Tallapoosa, Ga., are erecting an addition to and will put new machinery in their iron foundry and machine shop.

The foundation for the jewelry factory at Plainville Centre, R. I., is well under way. The shop is to be 40x80 feet, and three stories in height.

W. J. Gladish is endeavoring to organize a company to manufacture his patent saw-mill set works and duplex saw-mill dog at Chattanooga, Tenn.

Work on a hammer shop, a producer house, and a boiler house to be added to the Boies Steel Car Wheel Co.'s work at Scranton, has been begun.

It is reported that W. M. Wilhoite & Company will erect several new shop buildings to their wheel factory in Chattanooga, and put in new machinery.

The Beauce Asbestos Company has been organized at St. Francois de la Beauce, Quebec, with a capital of $10,000, to manufacture asbestos goods.

The Romig Manufacturing Company, of Auburn, N. Y., is to build a $12,000 factory of brick, five stories, 45'x60'. M. D. Makepiece is the architect.

The two-story brick addition to the principal shop of the Sigourney Tool Co., of Hartford, Conn., is completed. Other additions are said to be contemplated.

A number of Chattanooga (Tenn.) capitalists will, it is reported, make a proposition to establish a $25,000 electric light plant and ice factory in Monroe, N. C.

The Montreal Metal Works has been incorporated at Montreal, Can., with a capital stock of $50,000, and will manufacture and deal in wires, rods, cables, etc.

It is reported that a $23,000 bridge will be built across the James River, Howardsville, Va. The Virginia Steel, Iron and Slate Co. can probably give information.

The Martin Car Coupler Co., of Chicago, has been incorporated, to manufacture car couplers. Incorporators, Alex. C. Marvin, Flavius J. Barber and J. M. Corrigan.

The Maysville Fuel, Light and Steel Company have been incorporated, with a capital stock of $100,000, for the purpose of erecting a steel plant at Maysville, Ky.

The Blake & Johnson Company, of Waterbury, Conn., are about completing a new machine shop, 200'x45', two stories high, with basement and storage-rooms.

The Kremer Manufacturing Company, Pittsburgh, Pa., has been incorporated by David McK. Lloyd, Wm. E. Woodwell and J. W. Orth, all of that city. The capital is $25,000.

The Lodge & Davis Machine Tool Co., Cincinnati, O., has, we are informed, appointed M. P. Satterthwaite, 173 Superior street, as the representative for Cleveland, O., and vicinity.

It is stated that a Pittsburgh company will locate a large steel plant in Lincoln township, above Reynoldton, about two miles from McKeesport, Pa. It will have a capital stock of $300,000.

The American Nut Lock Co., of St. Louis, is enlarging its plant so as to double its present capacity. When the improvements are completed the works will turn out 30,000 nut locks daily.

The steel works at Greensburg, Pa., which have been shut down for a year, have been purchased by a syndicate of eastern capitalists, and, it is said, will be put in operation next month.

The Bone Valley Phosphate Co., recently reported as incorporated, etc., will develop at once its phosphate mines near Bartow, Fla., and has commenced the erection of a 100-ton phosphate plant.

The Foster Machine Company, now of Springfield, Mass., will remove to Westfield, Mass., where a new factory will be erected, and the works operated by water-power. The main building will be 150'x50'.

W. H. Harris, J. O. Lee, J. M. Frazee and others, have incorporated the Maysville Fuel, Light and Steel Company, with a capital stock of $100,000, for the purpose of erecting a steel plant at Maysville, Ky.

Beginning last Monday, the puddling department of the Structural Iron Works at New Albany, Ind., are to run day and night, and employment has thus been given to a large additional force of men.

The Willson Aluminum Co. has been organized, to manufacture aluminum by the T. S. Willson patent process, and is now erecting aluminum works at Spray, N. C.; plant will have capacity of 400 pounds daily.

The West Virginia and Pittsburgh Railroad Company, and the Warm Springs branch of the Chesapeake and Ohio, are to erect and maintain at Marlinton, W. Va., separate independent machine shops.

The Lindsley Terminal Equipment Co., of Chicago, has been incorporated, to manufacture railway equipments. Capital stock, $10,000. Incorporators, D. Dudenhover, H. C. Williams and others.

The Champion Saw Company, Pittsburgh, Pa., has been incorporated by F. G. Rohrkaste, New Brighton, Pa.; J. D. McAulis, New Galilee, Pa., and J. W. Forbes, Beaver Falls, Pa. The capital stock is $60,000.

The Toronto Junction Manufacturing Company, at West Toronto Junction, Canada, is a new incorporation, with a capital stock of $50,000, to manufacture an improved lantern, and other hardware specialties.

The Van Dorston Cushioned Carrier Iron and Railway Supply Company has been incorporated at Alexandria, Va., with an authorized capital stock of $500,000 to manufacture carrier irons for railway cars, etc.

The contract for the erection of Shenango Valley Steel Co.'s plant at New Castle, Pa., has been awarded to the Pittsburgh Iron and Steel Engineering Co. The plant will have a capacity of 700 tons of billets per day.

Plans have been prepared for a machine shop and office building to be erected at Charleston, Mass., for the Carson Trench Machine Company of Boston, to be 22'x115', one-story, with a boiler house wing 10'x14'.

It is stated that a direct steel producing plant for the Lancaster process will be added to the industries of Cumberland, Md. A syndicate, composed of New York, Boston and Cumberland merchants, are at the head of it.

The rail-mill at the steel works at Pueblo, Col., made a test run last week preparatory to starting the mill on a long run. All the machinery and converters have been recently repaired, and the works are now in good order.

The Puget Sound Iron Company, Seattle, Wash., have filed articles of incorporation. The capital stock is fixed at $1,000,000, divided into 10,000 shares at $100 per share, and the right is reserved to increase the capital stock to $2,500,000.

There is water works agitation in Wichita, Kan.; Farmington, Me.; Lake City, Minn; Towson, Md.; Collinsville, Ala; Spokane, Wash.; Bradford, Vt.; San Bernardino, Cal.; Gonzales, Tex; Goldthwaite, Tex.; Greenville, Tenn.; Elberton, Ga.

A site has been selected for the Bessemer Steel Plant to be erected by the Shenango Valley Steel Company, at New Castle, Pa. The plant will be erected immediately opposite and adjacent to the rod-mill of the New Castle Wire Nail Company.

The Hercules Foundry Company, incorporated in Massachusetts, with A. L. Rand, president and O. B. Cole, treasurer, has lately purchased and will complete the iron foundry of the Pike Manufacturing Company, in course of erection at Pell City, Ala.

It is understood that the Phoenix Bridge Co., of Phoenixville, Pa., has been given the contract to build the East Tennessee, Virginia & Georgia bridge over the French Broad River at Leadvale, Tenn. The cost of the superstructure approaches $30,000.

The Peckham Street Car Wheel & Axle Co., recently reorganized as the Peckham Motor Truck and Wheel Co., has doubled the capacity of its plant at Kingston, N. Y., and expects to have facilities during the coming year for manufacturing at least 500 trucks.

The Mills Improved Pneumatic Brake Company, with principal office at Chicago, has been incorporated, to manufacture pneumatic brakes for electric, cable and steam cars. Capital stock, $600,000. Incorporators: Frank W. Mills, O. A Bogue and M. B. Mills.

The Northey Manufacturing Company, Toronto, Canada, has been incorporated, with a capital stock of $100,000, for the manufacture of steam pumps, machinery, engines, etc. This is an expansion of the business of the well-known firm of Northey & Co.

Another manufacturing establishment of considerable importance will be established at East St. Louis, Ill. The works will be known as the Southwestern Steel Post Company, and when in full operation, it is said, will give employment to a large number of men.

The plant of the Milwaukee Bridge & Iron Works at Milwaukee, Wis., has been purchased at assignee's sale by Julius G. Wagner, for $30,000. Mr. Wagner has been engaged in the manufacture of architectural iron work, and will continue the manufacture of bridges.

It is understood that the King Iron Bridge & Mfg. Co., of Cleveland, O., will build the iron bridge over the Potomac River at Benning road. The bridge is to be 500 feet in length, with a 24 foot roadway and two 15-feet footwalks. $60,000 has been appropriated for the work.

Dr. Gatling, the inventor of the famous gun of that name, has arranged to establish a great plant for the manufacture of heavy guns at Marion, Ind. A stock company has been organized, with $1,000,000 capital, of which all has been taken except $100,000, and that is guaranteed.

The New Jersey Railroad Signal Company, of Newark, N. J., has been formed, with a capital stock of $50,000. J. Dawson, of Kearney, N. J., and J. Wayland and W. H. Buckley, of Newark, are the promoters of the company, which will manufacture and sell railroad signals of all descriptions.

The Challenge Manufacturing Company has been organized at Portland, Me., for the purpose of manufacturing mining machinery. The company has a capital stock of $100,000, and its officers are: president, Jerome V. Allen, of Brockton, Mass.; treasurer, George A. Dunbar, of Brockton, Mass.

The San Diego Iron and Steel Company, recently organized at San Diego, Cal., has elected the following directors: Wm. P. Shinn, Dr. C. J. Eames, Warren Wilson, J. F. Neeley and Mr. McCreary. Dr. C. J. Eames is president, J. F. Neeley vice-president, and Warren Wilson secretary and treasurer.

The Pittsburgh Bridge Company, of Pittsburgh, will shortly increase their capital stock from $150,000 to $200,000. A number of extensive improvements are being made to the plant of this firm, and their business is growing very rapidly, which is given as a reason for this increase in their capital stock.

The Buckeye Engine Co., Salem, O., has issued part third of its well-known catalogue. This part refers especially to compound engines. The subject is gone through with in a very interesting and instructive manner, and the catalogue is one that will be filed away amongst the things of interest to engineers.

The Prentiss Vise Co., 44 Barclay street, New York, has issued a new illustrated catalogue of the large variety of vises built at their works. The plan of using numbers is employed for designating sizes and kinds of vises and their patrons are urged to destroy all previous catalogues—of course, preserving the new one.

The Central Car Repair and Manufacturing Company, of Chicago, has been incorporated, with a capital stock of $625,000, to manufacture and deal in and repair railway cars and railway specialties. Incorporators: Henry R. Rebbles, Normand S. Patton and Reynolds Fisher. Stockholders: David J. Kurtz, Peter S. Grosscup, and Frank I. Wean.

The Hoffman-Keefe Company at Milwaukee, Wis., will build an addition 150 feet long to its new factory. The foundation walls are now being built. The building was originally intended to be larger than it now is, but part of it had to be made ready for occupancy before the other part was built, in order that the company might begin operations.

The D. & D. Electric Manufacturing Company, of Minneapolis, Minn., has organized for the manufacture and sale of electric motors and dynamos, elevators and other machinery and apparatus, and filed articles with the secretary of state. The capital stock is $50,000, and the incorporators are Gilbert Donaldson, Thomas Doves, and Frederick C. James.

The Youngstown (O.) Bridge Co., whose works were recently destroyed by fire, has effected an amicable settlement with the insurance companies, and a force of 100 men has been put to work clearing away the debris preparatory to erecting new buildings. The new works will be much larger than the old ones, and will be made as nearly fire-proof as possible.

A new steel bridge is to be erected at King street, Bownanville, Ont., the estimated cost of which is $10,000. The bridge is to consist of two spans of 85 feet each, 18 feet roadway, with wing wall, riprap and cedar piling for the protection of the approaches. The foundations of the masonry are to be set on piles. The bridge proper will be 20 feet above low water level.

The Savernake Tin plate Co. has been incorporated, with Titus S. Emory, of Philadelphia, Pa., as president; Thomas Dunlap, of Savernake, vice-president, and L. T. Marye, of Richmond, secretary, to mine and smelt iron ore and tin, and to establish steel and tin-plate works at Savernake (P. O. Trifford), Va. The capital stock is $1,000,000. Thomas Dunlap can give information.

A correspondent from Monticello, Wis., writes us as follows: I wish to rectify a mistake that occurred in your paper some time ago in regard to the Monticello woolen-mills being sold to J. Proctor. The mill was not sold to J. Proctor, but is owned and operated by D. Kennedy, and is run on all wool sheetings and blankets, etc. He also does custom carding and spinning.

A Pintsch gas plant is about completed at Omaha, and will soon be used to charge all the passenger cars running on the Chicago, St. Paul, Minneapolis & Omaha, between Minneapolis and Duluth, and Kansas City, Sioux City and Omaha. Some of the cars of the through trains are now using Pintsch gas, being charged from the plant erected for the Chicago & Northwestern at Chicago.

J. & J. B. Milholland, Pittsburgh, Pa., have recently erected the machinery in a coal mining plant at Cumberland, Md., and the *Daily News* of that city has given uncommon notice to the plant. The plant appears to be supplied with all modern conveniences, and the engines will haul 45 mine cars, 6,200 pounds each, up an incline of four feet in one hundred at a speed of one mile in nine minutes. The company above-mentioned makes a specialty of mine plants, and has put in some notable ones.

Charles S. Beach writes: "As a notice for your 'Manufactures,' the Lasher Stocking Co., Bennington, Vt., having purchased the entire interest of W. H. Bradford, in the stocking business and machinery, as built under the patents of Lasher & Beach, are now building a mill 150'x40', 2 stories; also engine and boiler houses of brick, from designs by Lockwood, Greene & Co. They hope to be in running order early in 1892. The power is furnished by a Straight Line engine and Lowe boiler. Officers are Frank Lasher, president and general superintendent; Charles S. Beach, treasurer and master mechanic; Edw. A. Booth, secretary."

John W. Morrison, Sr., Youngstown, O., writes us in relation to a note that appeared in these columns, as follows: "In your issue of September 17 I notice that you have made a mistake. You say that J. W. Morrison & Co., brass founders, of Youngstown, O., are increasing their capacity, and have taken Samuel W. Luce, of Boston, in as a partner of the firm. The firm of J. W. Morrison & Co., of Youngstown, O., are iron brokers, and are J. W. Morrison, Sr., and Samuel W. Luce, of Boston, recently taken into the firm. The facts are, I have added to the Youngstown Brass Works on the same lot, buildings and equipments for making iron castings and doing machine work, as my heading will show, and if you will be kind enough to correct the error in your next issue you will confer upon me a favor, as it has a tendency of mixing up our business affairs."

Kirkaldy's Book on Testing.

In our issue of June 18, we published a review of Mr. William G. Kirkaldy's book purporting to describe the system of testing pursued in the laboratory of his illustrious father, Mr. David Kirkaldy. Those of our readers who remember the review will recall that it was not a favorable one for the book, and its publication has called forth the following letter from the author, which was written to D. Van Nostrand & Co., who publish the book in this country, permission being given to make any use of it that seemed proper to them. We publish below all the essential parts of the letter, and following that a letter in reply from our reviewer.

. . . . Besides writing to my publishers, I feel it to be necessary to send you my comments upon the paragraph which appeared in the American Machinist, in order that you be not deceived, and my book prejudiced by it.

The paragraph is not only written in such a biased tone, but contains, moreover, such gross misrepresentations, that it is not worthy the name of a criticism or review.

I may briefly mention the following points to which exception must be taken. The critic withholds, in the first place, even the *title page*, which, if given, would in itself have precluded him from the pretended line of argument which he has assumed. Upon the very first page of the introduction it is distinctly stated that the section upon the System of Testing is treated "not with a view to teaching persons how to test, but for the purpose of letting engineers and others know, in a general way, how the work is carried out, and especially so that they may the better understand and appreciate the contents of the series of reports and plates, as well as the contents of original or manuscript reports which may come into their hands. The subdivisions of this section are restricted in extent as much as is deemed compatible with clearness." This distinct explanation is ignored, and the would-be critic assumes the book to be written as a work specially for those, the minority, who have to do with the carrying out of tests; but even for such there is a large amount of information set forth, which ought to prove of real service.

The critic writes: "It pretends to give an illustration of the famous Kirkaldy testing machine; . . ." here again he allows himself to be carried away by evident desire

to damage the work, and in a very unfair manner; the illustration he refers to is one of a series of views of the several floors of the building, and is titled distinctly "Testing-room," and in no place in the book is it said to be a detail view of the testing machine. The view being executed as faithfully as possible from a photograph, his charge of suppressing parts of the machine is unfounded. Had I decided to give the details of the machine it would have been by steel engravings, and not by a wood-cut; but as the machine is now well known to engineers it was not deemed of importance to reproduce it. Several thousand engineers have now seen the machine in action, and had its details explained to them; no one has been refused admission, yet it is recklessly and untruthfully represented that "no information will be given."

With reference to remarks about the calibrating of machines he goes out of his way to assume that it is not done here. This is hardly worth refuting; the very fact that Kirkaldy has existed, and that his work and reports have stood the searching criticism of twenty-five years is the best reply. It may be added, however, that every care *is* taken to see that the testing machine is continually maintained in the highest efficiency, and that its accuracy and delicacy is continually checked.

I considered, and still consider that the presenting a large assortment of tabulated statements or reports, showing exactly what the testing machine was capable of doing, and regularly doing, was better than any amount of description, and what would appear like bragging about its great delicacy of action. These tabular statements contain the results of 11,786 experiments of varied character, and comprising an extensive range of materials; although the statistics occupy 104 quarto pages no mention is even made of their existence by this remarkable critic.

Very many of the remarks are entirely misleading, and a fair reading of the book will show them to be unwarranted; no notice is taken of explanations therein, which ought to have been sufficient to prevent the reckless and sweeping strictures in which he has indulged. A reference to Reports L, M, N, O, P, is sufficient to prove on examination how little reliance is to be placed upon his remarks, such as, "They are merely interpolations of a few observations" I think that it would have been more seemly, had the would-be critic pointed out inaccuracies in the reports before giving himself away to writing an abusive paragraph. But I feel confident that the independence and fairness of American engineers will preclude them from condemning a book upon such an article; and I have no doubt that those who obtain copies of it will find that the contents are thoroughly reliable.

In closing, I must deprecate the unfeeling way in which the man who wrote that article should use the word "pretense" in connection with the work. Whatever he may think of the book he is not entitled to indulge in such an expression, as it has been admitted by all who have come across David Kirkaldy that he has been thoroughly in earnest. I would point out that in *no* case has Kirkaldy attacked any one, but he has merely defended himself from those who have attacked him (by misrepresenting or misquoting his work), which is a *very important difference*. There are forms of attack which a man is bound to refute, and it has been my father's line of action to take notice only of such, and my duty to place on record the outstanding cases. An unbiased and thoughtful consideration of the language used in the book will, I feel, show from internal evidence that it is carefully and judiciously chosen; the reasons are clearly set forth before strictures are made upon any person. . . . .

WILLIAM G. KIRKALDY.

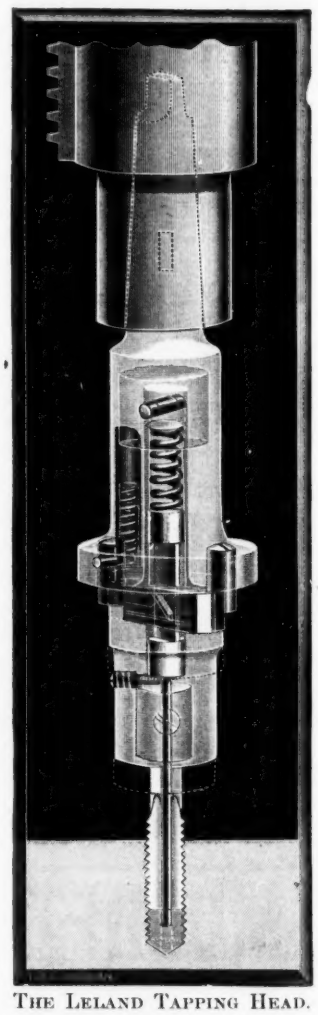
Editor American Machinist:

After reading the above letter I can only say that it seems to me the author of the book has misunderstood my criticism of it in some respects, and especially has he misunderstood the spirit in which it was written. I am certainly not conscious of having been other than desirous to be entirely fair to the book, to the elder Kirkaldy, and to your readers. The criticism was, of course, written from the standpoint of an engineer familiar with testing materials, as that seems to me to be the only proper standpoint from which to review such a book coming from such a source. With the following statement of what appear to me to be facts bearing upon the question at issue, I, as the lawyers say, rest my case.

The title as given, "Strength and Properties of Materials, with Description of System of Testing," was quoted from first in side title page, and is complete, as there given. It should, therefore, it seems to me, be taken as fairly representing the aim and scope of the book. If it does not do this it is misleading.

The second title page is rather in the nature of a catalogue of the contents of the book, and is really too long for quoting unless absolutely necessary, which did not seem to me to be the case. On back of cover of book, however, the title reads (and I invite special attention to the terms), "Kirkaldy's System of Testing, with Data upon Strength and Properties of Materials." It is nowhere mentioned as a system of *tests*, but always as a system of *testing*, which, it seems to me, refers to methods and means, not merely to kind of tests, with their results.

It is said on page vii, in regard to second object (Section II, "To explain the system of carrying out experiments of various classes"),. . . . "but for the purpose of letting engineers and others know in a general way how the work is carried out, and especially so that they may the better understand and appreciate the contents of the series of Reports and Plates, etc., etc." Now it seems to me the only way to make *testing* better understood, and to secure appreciation of reports and plates, is to give a clear and full description of how the tests have been made, and how results have been obtained.



THE LELAND TAPPING HEAD.

My position in regard to this point is confirmed by the elder Kirkaldy himself, as witness his "Conclusion" 49, on page 212 of the book in question. The forty-ninth conclusion reads as follows: "It is necessary to know correctly the exact conditions under which any tests are made, before we can equitably compare results obtained from different quarters."

Though the kind of tests made are mentioned and amply exemplified, and in some cases described, I do not find anywhere in the book any description of the method of testing. The methods of determining elongation or measuring reduced area at a fracture are not described, and it is not mentioned that different methods give different results.

The heading of Section I is: "Description of Testing Works," and on page xi, in the table of contents, we find: "I—Description of Building and Contents." Under these two heads all that is given is a woodcut, which, so far as I can see, is utterly useless to any engineer, for it gives only a partial and illegible view of the testing machine. The only "Description of Contents" under this head, so far as it relates to the testing machine, is a simple bald statement that the building contains a testing machine. How can a testing laboratory be described without primarily describing the testing machine and auxiliary apparatus? This part of the book reminds me of "the play of Hamlet with Hamlet left out." Nowhere in the book does the author say anything about either the machine or auxiliary apparatus, except to say in one place that elongations are measured with Kirkaldy's patent micrometer.

As to the statement that several thousands of engineers have seen the machine in operation, and had its details explained to them, let me quote from the written words of an engineer friend of mine, who visited the works within a few years, I think in 1888 or '89. He says:

"I arrived while an ordinary tension test of about 1½" round rod was going on, and was detained in the outer office until the test had been terminated; being told that he (David Kirkaldy) could not take me into the testing room while the machine was in operation. After waiting fully twenty minutes, a sudden violent shock, sufficient to make things tremble, was heard, this being caused by the rupture of the bar. David Kirkaldy then personally conducted me around the testing machine in as fast a walk as a man of his age is capable of, without allowing me to stop one moment to look at anything; nor would he explain the least thing, when asked to do so while passing the machine, nor even answer a single question about it afterward. Thence I was shown to the museum."

The question naturally arises here, how many of the thousands of other engineers who have seen the machine saw it in the same way? And seeing it in this way, how much could they know of the machine? Obviously, nothing worth speaking of.

Nowhere in this book, nor in any other publication, so far as I am aware, has David Kirkaldy ever given any description of his auxiliary apparatus, methods or results of calibration, or conditions under which he makes tests. It is not assumed that he does not calibrate his machine, but his methods and results not being given, he must permit and expect others to have full faith in the accuracy of his results or not, as taught by their own personal experience.

Examination of reports N, O and P shows that the curves on the plates drawn to them are, at their most interesting points, merely approximations obtained by interpolating those parts of curves lying between the particular points obtained by observation. For example, report P and plate VI, test No. 2,663, no observations of extension are given between loads of 40,000 and 42,000 pounds per square inch; nor between loads of 50,000 and 66,971 pounds per square inch; yet the most variable and interesting curves occur between these intervals. These have not been obtained by observation, but by interpolation. Owing to the importance of the curve at these points, it is obvious that it should be drawn from actual observation.

On page 197 it is stated that there is no diminution of stress after reaching maximum load, hence, in accordance with this statement, the curves relating to ductile materials are all drawn vertical at the lower ends. This can be nothing else than an error, into which Kirkaldy has been led by the fact that his machine is of such construction that it does not indicate any reduction of resistance at instant of fracture. It has been demonstrated by tens of thousands of tests that there is a decided diminution of resistance before fracture in all ductile materials.

The author of the book, in his letter, assumes that the word pretense used by me was intended to apply to his father. An examination of the review will show that it was not so intended, and that it does not so apply. YOUR REVIEWER.

The Leland Tapping Head.

In our issue of December 8, 1888, we illustrated a tapping head which has since that time been simplified, and is now made in the form shown by the accompanying illustration.

The device is intended to be used in a drill press or similar machine which is provided with a reversing belt by which the tap is backed out.

In using the device it is only necessary to lower the spindle of the machine until the tap comes into contact with the work. The tapping then proceeds until the small tap spindle, which passes through the center of the tap, comes into contact with the bottom of the hole; its descent being thereby arrested, it disconnects the clutch, allowing the spindle to revolve freely without turning the tap. The machine is then reversed, the spindle being raised slightly until the pin, passing through shank of lower member, drops to its seat in chamber of upper member, and comes in contact with side reversing pin.

Any failure of the operator to follow up lead of tap in going in or backing out is provided for by a safety trip for the side reversing pin and clearance between upper and lower members.

The head enables either through or bottomed holes to be tapped to any required depth without changing the adjustment from one size to another. They are made in two sizes, one to tap from ⅜" to 1¼", the other for ¼" to ¾", by the Hampden Tool Company, Holyoke, Mass.

Prof. L. P. Breckenridge, well known to our readers by his articles on the measurement of power required for cutting tools, has resigned his position as instructor at Lehigh University, and accepted the position of Professor of Mechanical Engineering and Director of Shops, at the Michigan Agricultural College. As head of the mechanical engineering department Prof. Breckenridge will, of course, have an enlarged field in which to occupy his energies, and those who know him will, of course, expect him to be entirely successful.

Mr. James E. Tribe writes us: "I notice a slight error in my figures of the note under Example 8, fifth paper. The reading is 23.8 + 1 = 24.8. It should read 23.8 + 1.4 = 25.2 pounds."

Machinists' Supplies and Iron.

NEW YORK, October 10, 1891.

Iron—American Pig—On a somewhat lower basis of values, the market is quite active, considerable business having been done.

We quote: Standard Northern brands, No. 1 Foundry, at $16.75 to $18; No. 2 is selling at $15.50 to $16.50, and Gray Forge at $13.90 to $15. Southern brands of good quality are obtainable at $16 to $17.50 for No. 1 Foundry; $15.75 to $16 for No. 2; and $14 to $14.50 for No. 3.

Scotch Pig—We quote Coltness at $23, and Eglington at $20.50.

Copper—There is no change of importance in the general condition of the market here, though it is easier abroad. For immediate delivery Lake Copper can be had at 12.35c. Casting copper continues steady at 11¾c. to 11⅞c.; and Arizona Ingot at 12c. to 12¼c.

Lead—Pig Lead is dull, but prices are firmly maintained, holders asking 4.55c., and bidders offering 4.50c for spot supplies.

Spelter—There is little or no demand, and prices are nominal at 5c. to 5 05c.

Tin—The trading is light, but prices are somewhat firmer. Values range about 20.10c. by the ton.

Antimony—The market is firm, and there has been no change in prices.

We quote 10⅝c. for Hallett's, 13¼c. for Cookson's, and 10⅞c. for L. X.

Lard Oil—The market is steady at 55c. to 56c. for Prime City, according to holder and quantity. Western on spot is quoted at 54c. to 55c.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

1st-class pattern maker, English, age 35, desires situation as foreman. BOX 79, AMER. MACHINIST.

Wanted—Molder with small capital to operate iron foundry. Address C., AMERICAN MACHINIST.

A skillful mechanical draftsman, recently having charge of drawing-room, desires engagement; thoroughly competent; ex. refs. BOX 75, AM. MACH.

Wanted—A man to run a shafting lathe; state experience, references, and wages expected. C. W. Osgood & Son, Bellows Falls, Vermont.

Position Wanted—To travel with or set up steam, hydraulic or electric machinery. Correspondence solicited. Traveler, AMERICAN MACHINIST.

Wanted—Situation as chief engineer of steam plant; fifteen years' experience in building and running engines. Chief Engineer, care AM. MACHINIST.

Wanted—Die makers, experienced in making square and irregular dies for tinware. Write to the Niagara Stamping and Tool Co., Buffalo, N. Y.

Wanted—Situation as supt. or foreman on automatic engines; fifteen years' experience; No. 1 references. Address Reliable, care AM. MACHINIST.

A brass finisher is open for engagement ass upt., with respectable American parties in any part of this country. "Prompt," AMERICAN MACHINIST.

Wanted—An engineer and machinist to set up engines; state experience, and wages expected. C. H. Brown & Co., Fitchburg, Mass.

Draftsman and machinist, age, 32, exp'd in locomotive eng. work, desires employment as draftsman in railroad shop. D. M., AMERICAN MACHINIST.

First-class mech. draftsman, exp'd in steam plants, Corliss and slide valve engines, pumping and transmission mach'y, wants situation. "Z," AM. MACH.

Wanted—Position by first-class tool maker and machinist, to act as foreman; capable of handling help to advantage. Address F. B. B., AM. MACHINIST.

Wanted—Situation by a young Swede; M. E.; 10 years' exp. in the drawing-room, and one year shop practice; A1 refs.; specialty, ordinary and special machine tools. Address "32 Years," AM. MACHINIST.

Boiler makers wanted; steady work at good wages to good all-around non union workmen. Address Merrill-Stevens Eng. Co., 138-140 S. Bay Street, Jacksonville, Fla.

Draftsman and designer of mach. tools, gen. and spec. mach'y, familiar with modern shop practice, especially miller and turret lathe work, desires a change. BOX 78, AMERICAN MACHINIST.

Wanted—Position as foreman boiler maker by a man of large experience with locomotive, stationary and all kinds of sheet-iron work; best of refs.; 10 years as foreman. Address Box 61, AM. MACH.

Tool maker wanted; a first-class man, accustomed to engineers' and steam fitters' brass work; steady employment. James Morrison, 91 Adelaide Street West, Toronto.

Wanted—Position to run Brown & Sharpe grinding machinery; a thorough knowledge of the machine, and capable of doing any class of work. E. L. L., No. 119 Golden Hill St., Bridgeport, Conn.

Foreman, with large and varied exp.,—watch-work, instruments, light and heavy mach'y—good theoretical knowledge, desires change of position; prefer a place where ability and integrity could secure interest in the business; ref. B., AM. MACHINIST.

Wanted—By a well-established iron construction company, a competent engineer; must be well versed in structural iron work for fire-proof buildings, well acquainted with architects in N. Y. City and vicinity, and able to take off items and make up the cost of same; a valuable connection guaranteed the right party. Iron Works, 29 B'way, N. Y. City.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Corliss engs. and gen. mach'y designed, working drawings made. A. W. Jacobi, 136 Liberty St., N. Y.

Special leather and cement for covering pulleys; no rivets required; local agents wanted. Crescent Mfg. Company, Cleveland, Ohio.

For Sale Cheap or Exchange—Eleven right and left modern Patent Automatic Cut-off Engine Patterns & Drawings, from 10" to 20". B 9, AM. MACH

To manufacture light special machinery and tools to order by Orange Machine and Repair Works, Orange, N. J.

For Sale, Cheap—Patent for friction clutch pulley and cut-off coupling, patented March 24, 1891. J. Holmes, Box 586, Waterford, N. Y.

For Sale—The Aurora Foundry; new brick building, and everything in good order for light and heavy work. Address E. W. Wilson, Aurora, Neb.

Wanted—A1 machinist or pattern maker, to take an interest in my machine shop, to manufacture small engines. 2615 & 2617 Strand, Galveston, Texas.

Wanted—To receive proposals from manuf'r's to m'f'cture on royalty or buy my patent, No. 457,710; the only universal wood workman's vise; a gem, indeed. J. T. Emmert, Box 313, Waynesboro, Pa.

For Sale—Machine shop and foundry, with gas well; will sell entire plant or tools, stock and patterns, and lease buildings and gas; will take part pay in work. Address M., care AM. MACHINIST.

For Sale—Lot of partially completed two horse-power engines, boilers, tubing, etc. American B. H. O. & Sewing Machine Co., S. W. Cor. 20th and Washington Avenue, Philadelphia, Pa.

For Sale—One 10"x12" Ball Automatic Steam Engine, used several years, in good condition. Will sell cheap. Defiance Machine Works, Defiance, Ohio.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Answers addressed to our care will be forwarded.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

STEEL TUBES
WELDLESS
SMOOTH · COLD DRAWN
John S. Leng's Son & Co. New York.

*Bradley Hammers

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Men test everything in this world by what it produces.
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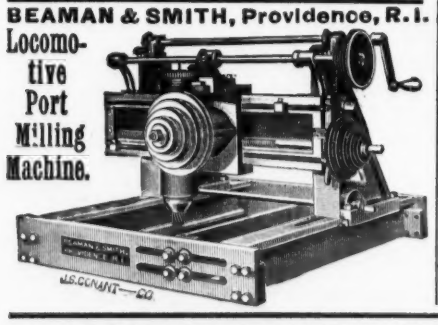
FOR SALE—One of the best paying, modern equipped, and very successful foundry and machine works located in a thriving western town of about 15,000, having a good class of labor, cheap fuel, and excellent shipping facilities, and employing 150 to 200 men. Property free from all incumbrances. Profits from $25,000 to $40,000 annually. Doing a well-established general business, mining machinery, and other specialties. This is a rare opportunity for some practical men in this line with capital. Reason for selling is on account of the death of mechanical member of the firm. Address
MANSFIELD, 52 Wall St., New York.

WIRE:
Its Manufacture and Uses.
By J. BUCKNALL SMITH, C. E.
400 pages, 150 illustrations. 8vo., cloth, . $3.00
JOHN WILEY & SONS, New York.

BEAMAN & SMITH, Providence, R. I.
Locomotive Port Milling Machine.



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Gear Cutting.
NOISELESS GEARS
for high speed gears and pinions a specialty.

WANTED.
A first-class Blacksmith and Wrought Iron Worker. One that can take charge of works employing seventy-five men. Must be capable of making drawings, calculating strengths, and do estimating. State salary required. Address
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Care of AMERICAN MACHINIST,
96 Fulton St., New York.

FITCHBURG MACHINE WORKS,
MANUFACTURERS OF
Metal-Working Machinery.
OFFICE AND WORKS:
Nos. 13 to 21 MAIN STREET,
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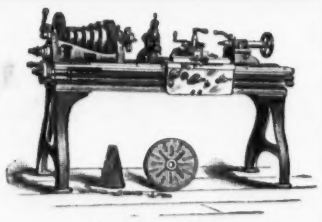

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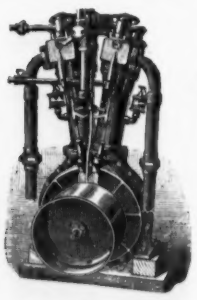

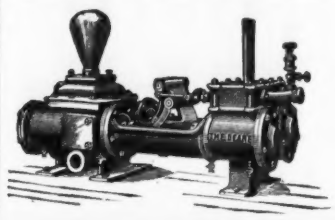

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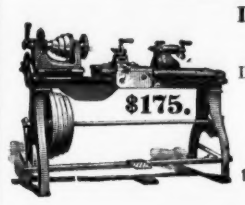

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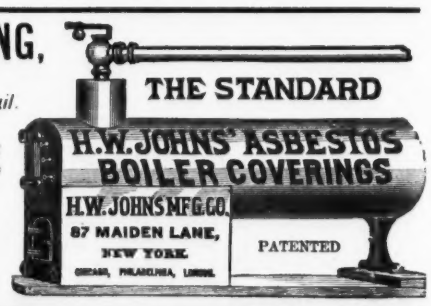

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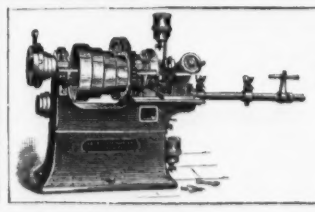

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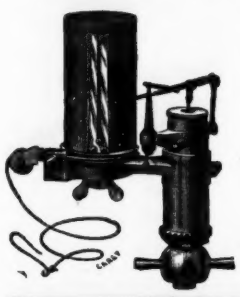

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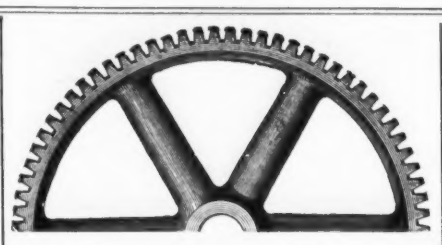

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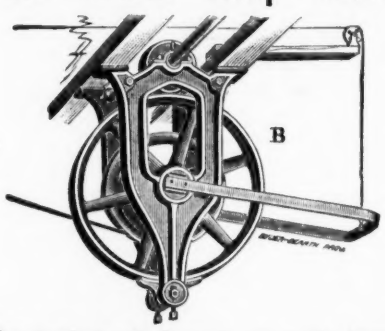

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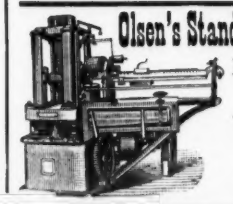

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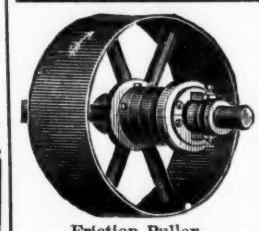

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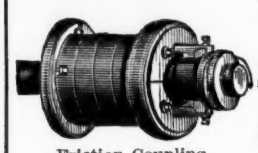

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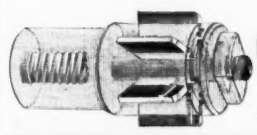

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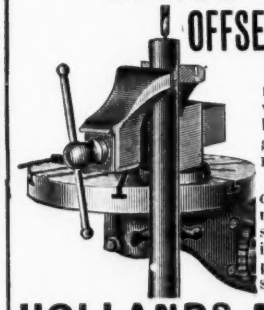

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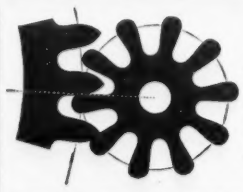

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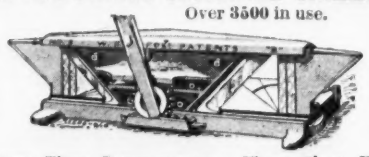

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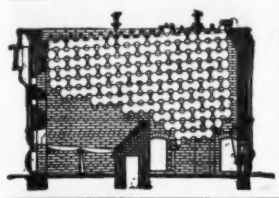

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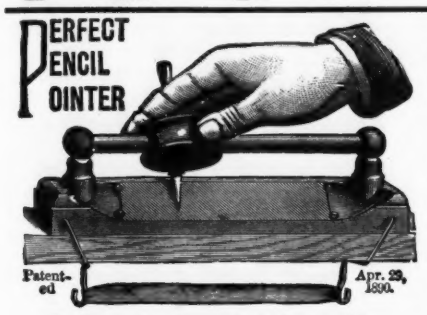

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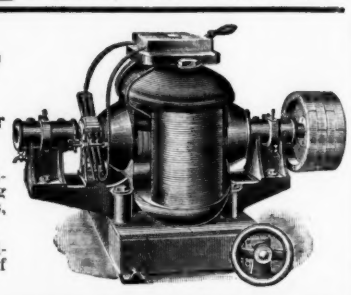

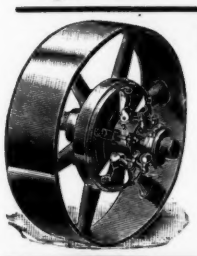

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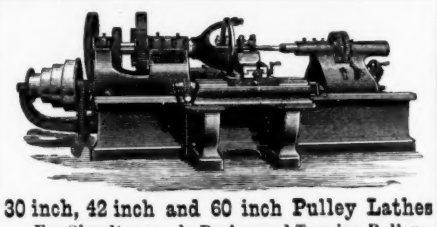

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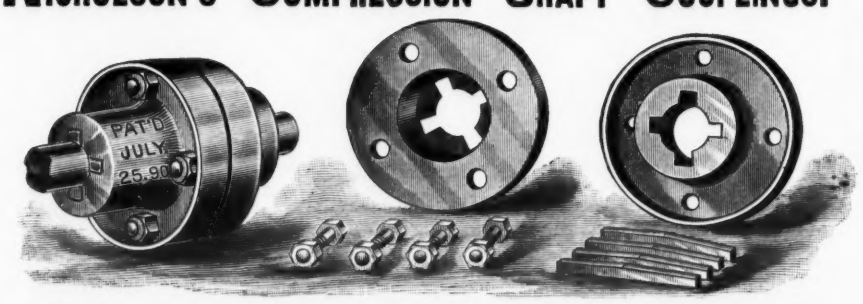

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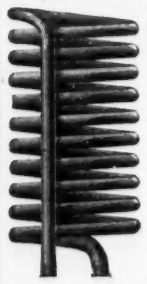

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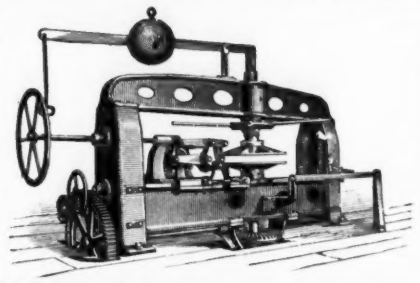

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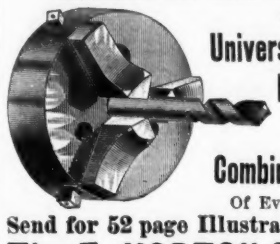

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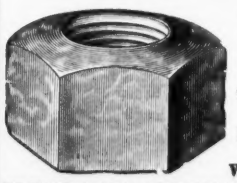

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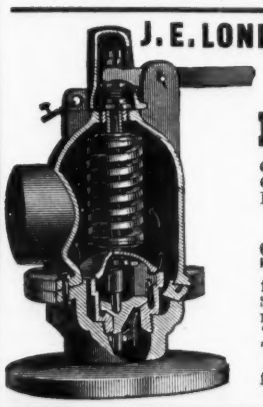

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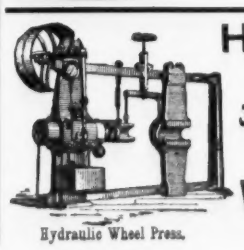

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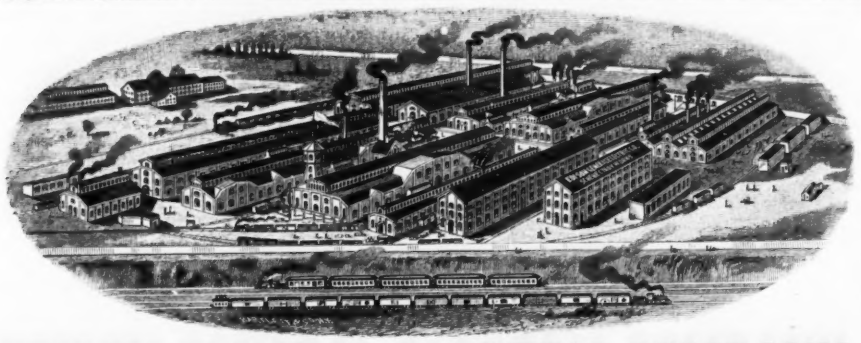

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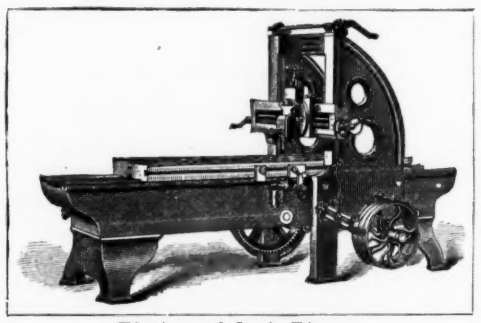

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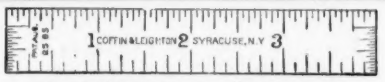

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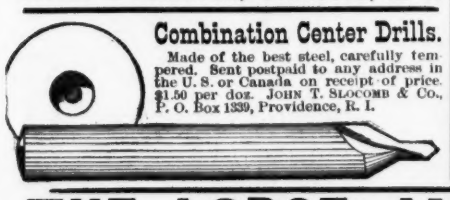

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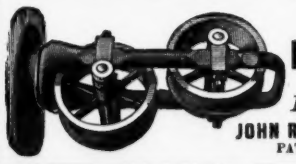

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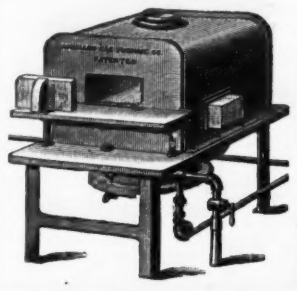

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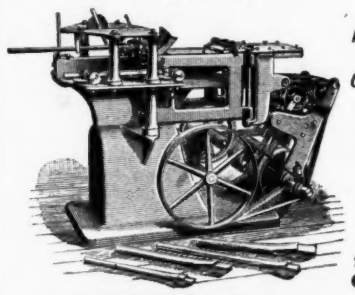

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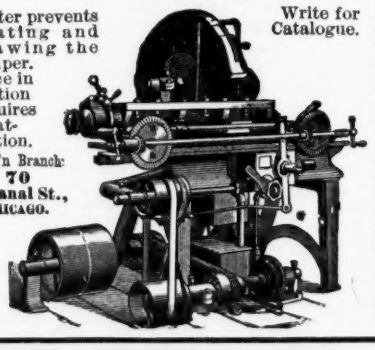

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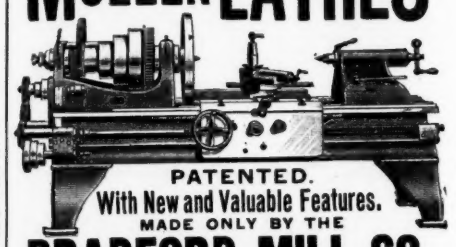

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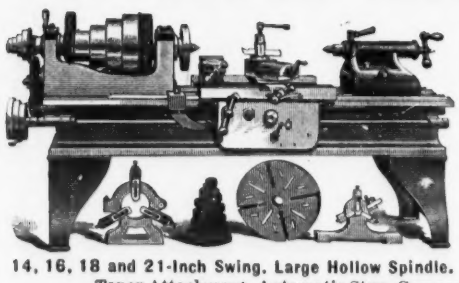

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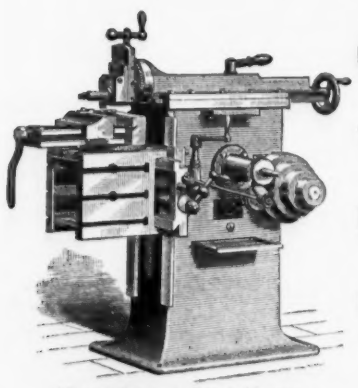
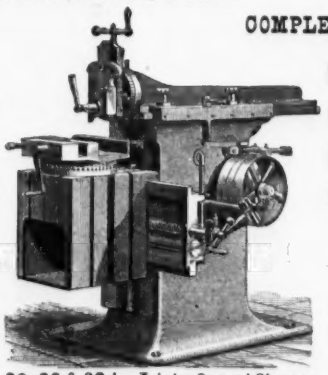


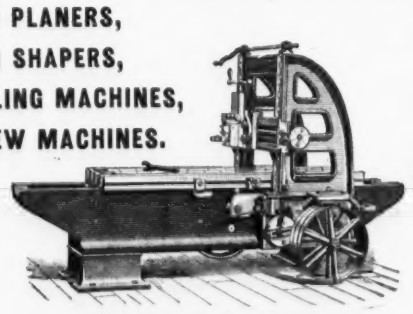
15 and 20-Inch Crank Shaper.
Stroke changed and adjusted while running. Stroke at all times positive.
Invariably plane to a line.
Detachable Tables.

ENGINE LATHES,
TURRET LATHES,
PULLEY LATHES,
CHUCKING LATHES.



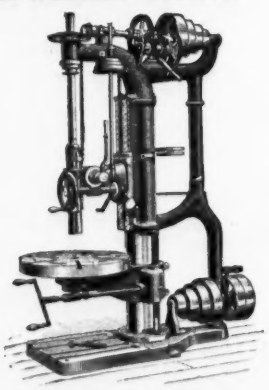
20, 26 & 32-In. Triple Geared Shapers.
Stroke changed while machine is running. Shaft can be passed through head of machine and key seat cut in same to any length. Extra heavy vises. Tables slotted on all sides.
Special 26-In. Shaper with auto. down feed.

IRON PLANERS,
IRON SHAPERS,
MILLING MACHINES,
SCREW MACHINES.



24, 32 and 36-Inch Planers.
Extra deep beds and tables. Powerfully geared. Plenty of Metal and designed for extra heavy duty. All Feeds and Shipper operated from both sides.
Improved device for holding Planer Bolts.

RADIAL DRILLS,
DRILL PRESSES,
BOILER MAKERS' DRILLS,
POST DRILLS.



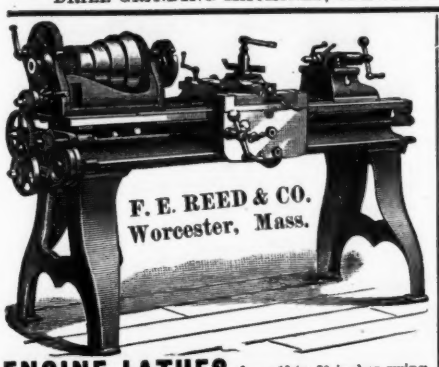
25, 28, 32 and 40-Inch Drills.
Automatic stop to feed. Quick return on right side. Table operated from front. Large cones and long belts.

See Advertisement on Page 20.

MORSE TWIST DRILL AND MACHINE COMPANY,

Manufacturers of **Morse Patent Straight-Lip Increase Twist Drills.** New Bedford, MASS.

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills.
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.



ENGINE LATHES from 10 to 30 inches swing.
Also Hand Lathes, Foot Lathes and Milling Machines.

FLATHER'S NEW PATTERN
22 Inch Engine Lathe,
Has many Original and Valuable Improvements.

HILL, CLARKE & CO.
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Price $8
NO GAUGES.
NO BELT.
Every Machine Guaranteed.

BARKER'S IMPROVED CENTER GRINDING MACHINE.
Manufactured by
WM. BARKER & CO.
CINCINNATI, O.
SEND FOR CIRCULAR.

☞ **IMMEDIATE DELIVERY.**
15" and 18" Crank
20" and 26" Geared } **SHAPERS.**
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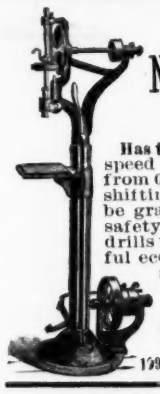
BARNES'
New Friction Disk Drill
FOR LIGHT WORK.



Has these Great Advantages: The speed can be instantly changed from 0 to 1600 without stopping or shifting belts. Power applied can be graduated to drive with equal safety the smallest or largest drills within its range—a wonderful economy in time and great saving in drill breakage.

Send for catalogue.

W. F. & JNO. BARNES CO.,
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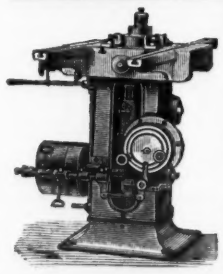

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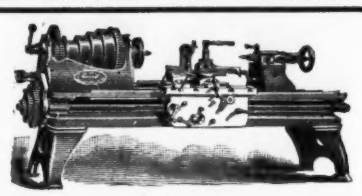
Portable and Stationary.
Rack-Cutting Attachment
Key-Making Machines.
Giant Key-Seater Co.
EAST SAGINAW, MICH.

April 25, 1891. We are very much pleased with it, and think it the best machine on market for simplicity and effective work. DAVIS & COWGILL IRON WORKS, Omaha, Neb.



NEW HAVEN MANFG. CO.
NEW HAVEN, CONN.
IRON-WORKING MACHINERY,
Planers, Shapers, Drills, Slotters, Etc.

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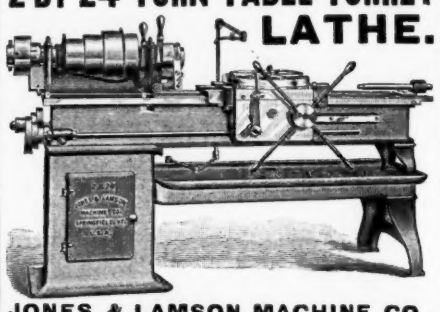
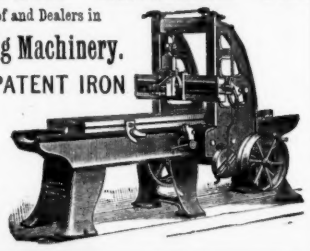
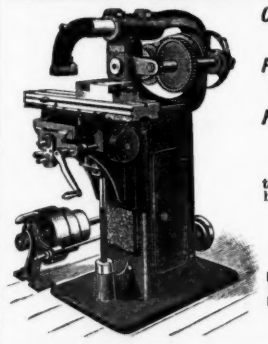
2 BY 24 TURN TABLE TURRET LATHE.



JONES & LAMSON MACHINE CO.,
Springfield, Vt., U. S. A.

L. W. POND MACHINE CO.
Manufacturers of and Dealers in
Iron Working Machinery.
IMPROVED PATENT IRON PLANERS A SPECIALTY.
152 Union St., WORCESTER, MASS.





Complete Universal Milling Machines.
Plain Back Geared Milling Machines.
Plain Universal Heads.

All designed to meet the requirements of the best practice.

KEMPSMITH Machine Tool Co.,
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GAGE MACHINE WORKS,

MANUFACTURERS OF
MACHINE TOOLS,
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D. SAUNDERS' SONS,

21 ATHERTON ST., Yonkers, N. Y.
MANUFACTURERS OF

Steam & Gas Fitters' Hand Tools. **Pipe Cutting,** THREADING, AND **Tapping Machines.**

SEND FOR CIRCULAR.

THE PATENT WHEEL PIPE CUTTER shown in the cut combines simplicity with strength and lightness. Easily adapted to various sizes of pipe. Rolling instead of sliding motion. No loose parts to become detached and mislaid. All wearing surfaces are of tool steel hardened. Less friction of parts than any other pipe cutter made.

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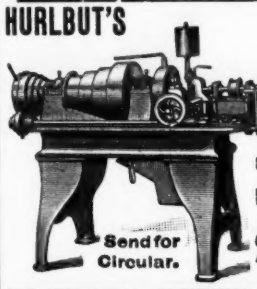

Patent Cutting-off and Centering Machine.
Sizes 2", 3", 4", 5", 6"
MADE BY
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South Sudbury, Mass.
Send for Circular.
Chas. Churchill & Co., Ltd. Agents, 21 Cross St., London England.

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Cincinnati Milling Machine COMPANY,
Plain and Universal Milling Machines and Universal Cutter Grinders.
N. E. Cor. SECOND AND PLUM STREETS,
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BARGAINS.
15 H. P. Erie City Engine.
20 H. P. Erie City Economy Boiler.
Engine in Good Condition (running).
Boiler (almost new).
5 H. P. Card Electric Motor in splendid order.

FOR SALE CHEAP.

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Lathes from 10 in. to 20in. swing. Largest Variety of Drills manufactured in the world.
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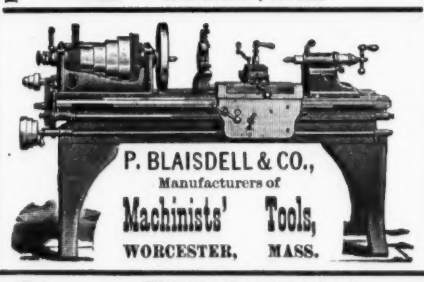

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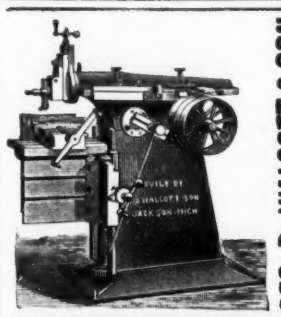

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Manufacturers of
LATHES AND SHAPERS
JACKSON, MICH.
WRITE US for PHOTO & PRICES

MACHINERY
For Reducing and Pointing Wire.
ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.
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ROSS ANTI-FRICTION BALL BEARING COLLAR.

A new Patent Application of Ball Bearing, patented Dec. 2, 1890, to Drill Presses. Lathe and all end thrust of Horizontal Shafts in Machinery. 95 per cent. of the friction overcome by this device. Full satisfaction guaranteed.

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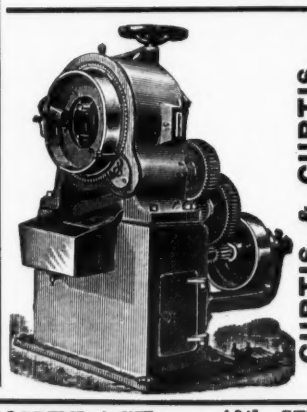

CURTIS & CURTIS,
66 GARDEN ST., BRIDGEPORT, CONN.
Pipe Cutting & Threading Machinery,
FOR HAND OR POWER.
RATCHET DRILLS, RATCHET DIE STOCKS AND MALLEABLE IRON PIPE VISES.

NEW SHOP. **PERFECT EQUIPMENT.** **NO MAKESHIFTS.**

AMPLE ROOM. PERFECT LIGHT. EASILY REACHED.

W. D. FORBES & CO.,
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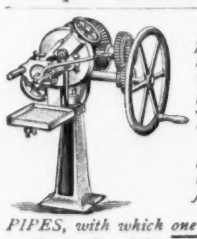
FINE TOOL AND MACHINE WORK.

CONTRACT, JOB, OR DAYS' WORK.

13th STREET, AND HUDSON, HOBOKEN.

"Eclipse" Hand Pipe-Cutting Machines.



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"ECLIPSE" Nos. 2 and 3. These are powerful and most efficient machines for cutting large PIPES, with which one man can easily cut off and thread 6-inch pipe.
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No. 3 " " " 2½ to 6 in.
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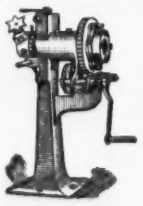

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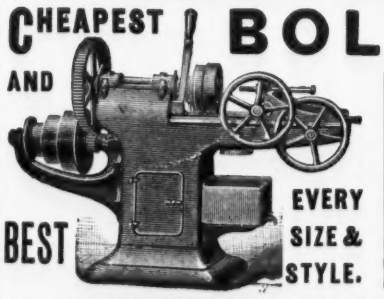
☞ We also build Power Machines.

CHEAPEST AND BEST BOLT CUTTERS.



EVERY SIZE & STYLE.

H. B. BROWN & CO.,
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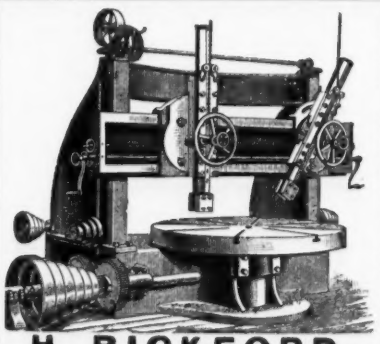

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Improved TURNTABLES for LOCOMOTIVES, CARS and PIVOT BRIDGES.
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Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven
PUNCHES and SHEARS,
OVER 300 SIZES.
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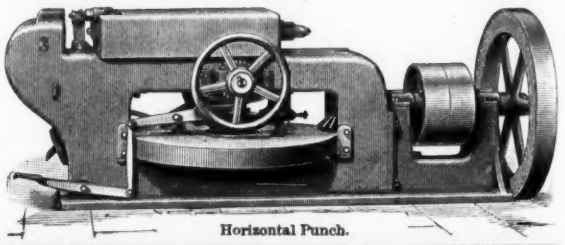
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IN STOCK AND TO ORDER.
When worn, Blades can be removed, reground, and readjusted to retain the original cutting diameter.
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60,000 CRANK SHAFTS and 50,000 GEAR WHEELS of this steel now running prove this.
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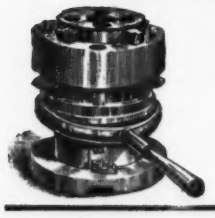

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6 Sizes and Styles of Rapid Bolt Cutters.
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15 Sizes and Styles of Bolt Headers.
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5 Sizes and Styles of Benders.
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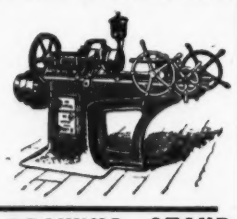

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No. 2.
For High Speed Milling.
An indispensable Tool in any well appointed machine shop.
Speeds from 240 to 10,000 revs.
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JOHN BECKER MANF'G CO.,
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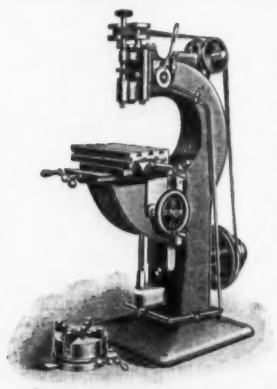

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PATENTED.
With or without board.
The best and most convenient Drawing Table in the world.
JONES & MACK,
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Universal AND Plain Grinding Machines,
4 SIZES.

Work and traverse instantly varied to any speed between extremes. Reversing points varied by hand. Pivoted table simultaneously clamped at both ends by hand, has no slot or screws on its end; easy to keep clean; is graduated in ¼ degrees and in taper in inches per foot.
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—BUILDERS OF—
METAL-WORKING MACHINE TOOLS
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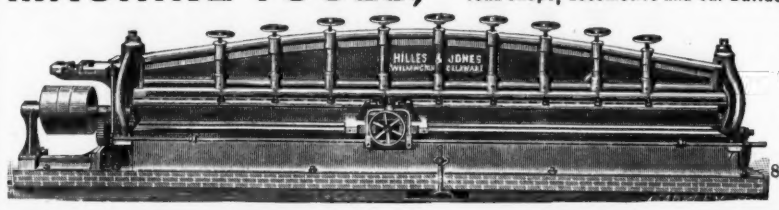
THE HILLES & JONES CO., WILMINGTON, DEL.,
MANUFACTURERS OF
MACHINE TOOLS, For Boiler Makers, Bridge Builders, Ship Builders, Railroad Shops, Locomotive and Car Builders, etc.



Improved Boiler Plate Planer.
Eight Sizes.
8′x20′ length of cut.

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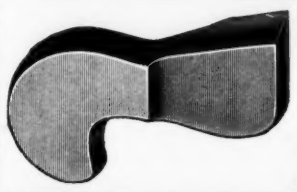

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ACME MACHINERY CO.
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Manufacturers of
ACME BOLT & RIVET HEADERS,
Acme Single & Double Automatic BOLT CUTTERS.
Cutting from 1-8 in. to 6 in. diameter.
Also SEPARATE HEADS and DIES.
FIRST PREMIUM, CINCINNATI CENTENNIAL.

PAT. DEC. 5, 1882.
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ENGINE LATHES.
17in. 20in. & 30in. Swings.
UNIVERSAL RADIAL DRILL CO., CINCINNATI, O. U.S.A.

WM. BERKEFELD'S FOSSIL MEAL COMPOSITION.
The Only Genuine Fossil Meal.

The best non-conducting material known for Steam Pipes and Boilers. Can be easily removed and repeatedly reapplied.
ITS PLASTIC NATURE INSURES AN ABSOLUTELY TIGHT JOINT.
Requires less thickness than any other covering, and is therefore the CHEAPEST.
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FRISBIE FRICTION PULLEYS AND CLUTCHES.
THE D. FRISBIE CO.,
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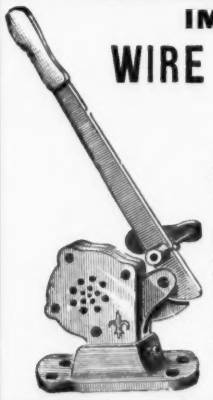
IMPROVED WIRE CUTTERS.



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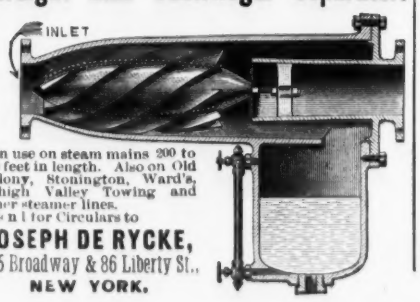
ABSOLUTELY DRY STEAM
CAN BE SECURED BY USING
Straight Line Centrifugal Separator.



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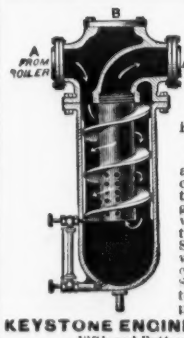

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Place Separator as close to engine as possible, the steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or B, as convenience may require, also used in conveying steam long distances, for Steam Hammers, Dry Houses, Water Gas Generators, and for all purposes where Dry Steam is necessary.
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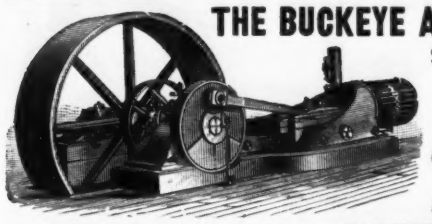

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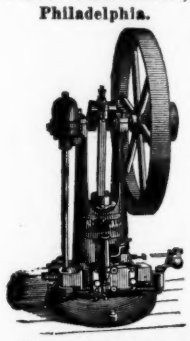

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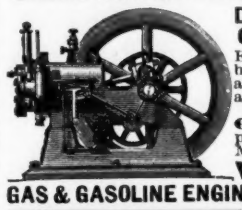

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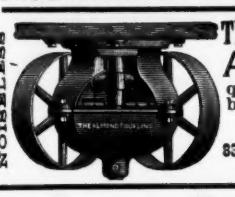

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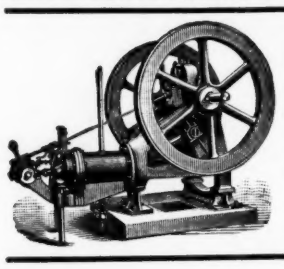

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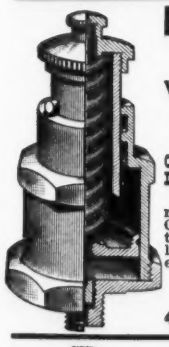

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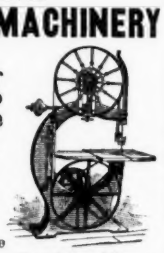

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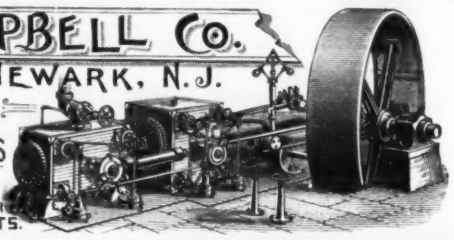

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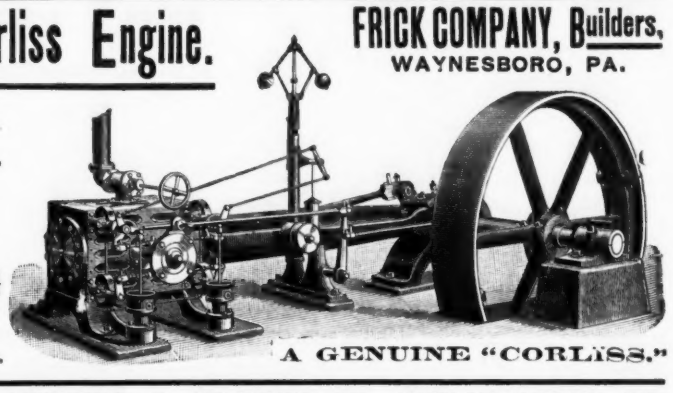

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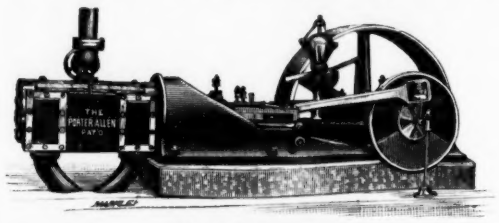

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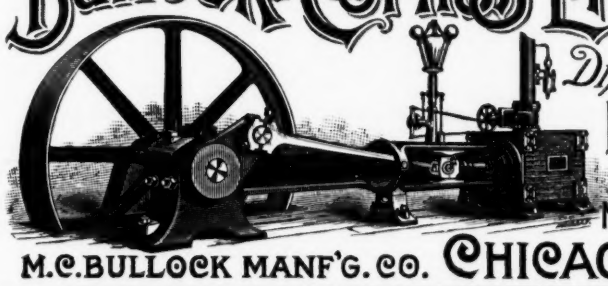

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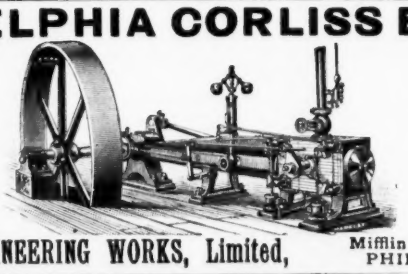

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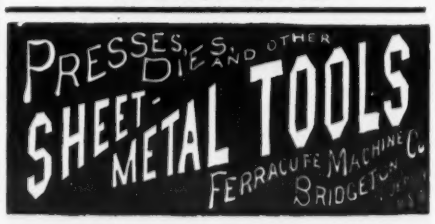

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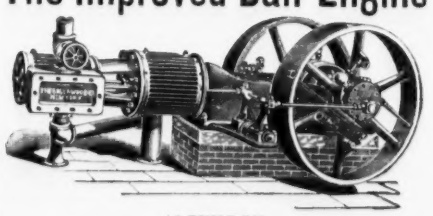

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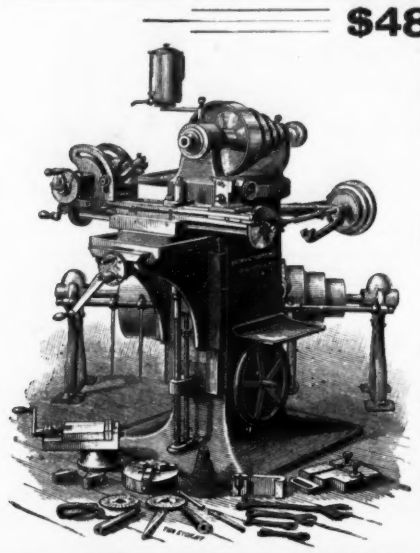

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with overhead works and everything shown in cut.

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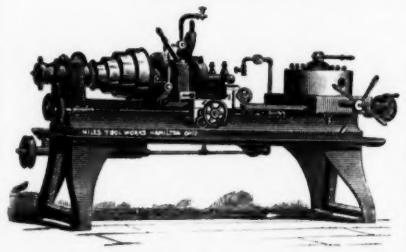

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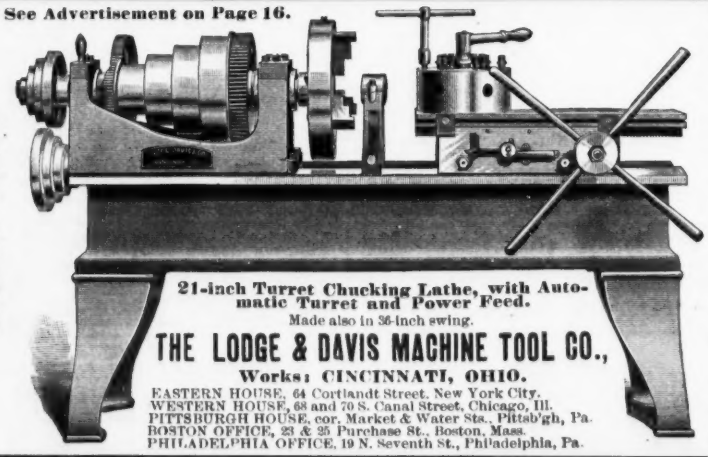

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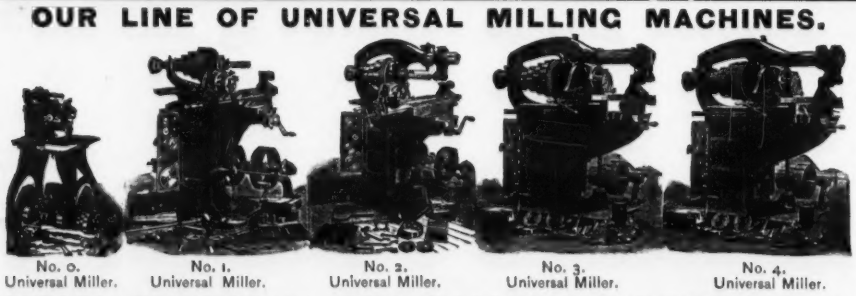

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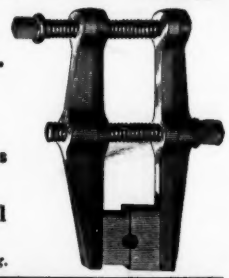

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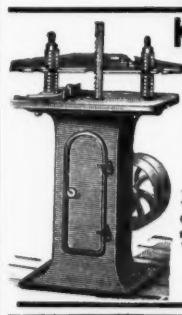

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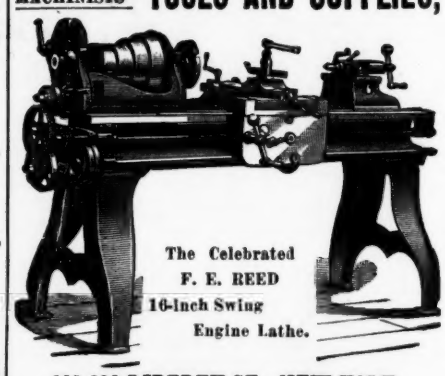

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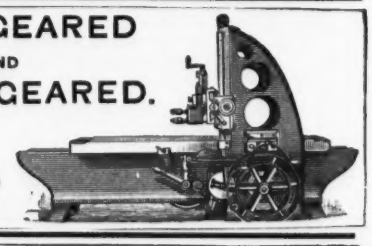
479 Sycamore St., CINCINNATI, O.



27" × 27" × 8' Planer. 20" × 6' Chucking Lathe. 16" × 6' Engine Lathe. 25" Pillar Shaper.

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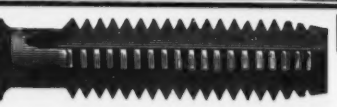

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